REPORT RESUMES

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NEW DIRECTIONS FOR INDUSTRIAL ARTS, ADDRESSES AND PROCEEDINGS OF THE ANNUAL CONVENTION OF THE AMERICAN INDUSTRIAL ARTS ASSOCIATION (26TH, WASHINGTON, 1964).

AMERICAN INDUSTRIAL ARTS ASSN., WASHINGTON, D.C.

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MOST OF THE IMPORTANT ADDRESSES GIVEN AT THE 26TH AMERICAN INDUSTRIAL ARTS ASSOCIATION CONVENTION ARE IN THIS REPORT. THEY INCLUDE (1) "INDUSTRIAL ARTS AND ECONOMIC GROWTH" BY E. MCCARTHY, (2) "THE MANPOWER PROBLEM--SOME CHALLENGES FOR ALL LEVELS OF EDUCATION" BY E. CLAGUE, (3) "NEW PRESSURES--AND OLD" BY H. BENJAMIN, (4) "IDENTIFYING THE STUDENT'S UNIQUE PATTERN OF TALENTS" BY J. C. FLANAGAN, (5) "INDUSTRIAL ARTS EDUCATION--A VIEW FROM THE OUTSIDE" BY E. J. MEADE, (6) "A NEW LOOK AT METHODS AND TECHNIQUES IN TEACHER DEVELOPMENT" BY R. S. ACKER, (7) "RESEARCH DEVELOPMENTS IN LEARNING--IMPLICATION FOR TEACHING" BY W. B. WAETJEN, (8) "NEW TRENDS AND DEVELOPMENTS" BY S. LAMBERT, (9) "WHERE DO YOU PUT THE I" BY E. K. EMURIAN, (10) "THE PEACE CORPS AND INDUSTRIAL ARTS" BY N. PARMER, (11) "DIRECTIONS IN POST-BACCALAUREATE TEACHER EDUCATION PROGRAMS" BY D. W. ROBINSON, (12) "NEW DIRECTIONS IN HIGHER EDUCATION" BY P. DEVORE, (13) "INDUSTRIAL DEVELOPMENTS AND THEIR IMPLICATIONS FOR INDUSTRIAL ARTS" BY W. P. SPENCE, (14) "INDUSTRIAL DEVELOPMENTS AND THEIR IMPLICATIONS FOR INDUSTRIAL ARTS CONTENT" BY D. SAMS, (15) "A NEW CONCEPT OF INTERPRETING PRODUCTIVE SOCIETY TO YOUTH--A DESCRIPTION OF THE ZIEL PROGRAM OF INDUSTRIAL ARTS" BY J.E. GALLAGHER, (16) "THE SCHOOL OF TOMORROW, TODAY" BY W. SMITH, (17) "A PROGRESSIVE INDUSTRIAL ARTS PROGRAM IN BROWARD COUNTY, FLORIDA" BY S. JOH[redacted] (18) "TECHNOLOGY--A STRUCTURE FOR INDUSTRIAL ARTS" BY P. DEVORE. THIS DOCUMENT IS AVAILABLE FOR $4.50 (HARD COVER) AND $3.50 (SOFT COVER) FROM EXECUTIVE SECRETARY, AIAA, 1201 SIXTEENTH STREET, N.W., WASHINGTON, D.C. 20036. (EM)

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NEW DIRECTIONS FOR INDUSTRIAL ARTS

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What is the AIAA?

The American Industrial Arts Association, Inc., an autonomous department of the National Education Association, is a national organization of industrial arts educators. The purpose of the Association is to improve the quality of instruction in the nation's industrial art programs. It was founded in 1939 to, as stated in its Articles of Incorporation, "Derive, define, and foster the professional ideals of industrial arts as a part of general education." For information on membership, write to Kenneth E. Dawson, executive secretary, AIAA, 1201 Sixteenth St., N.W., Washington, D. C. 20036.

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Foreword

This is the first annual report on the national convention of the American Industrial Arts Association. Its content includes most of the important addresses given March 30 to April 3 in Washington during the Association's 26th annual convention. The addresses point up the convention's theme, "New Directions for Industrial Arts."

It seems appropriate, indeed, that this theme is the title of the volume, since we believe that this report is an achievement and another of many new and significant services for AIAA members. The content of this book is, most probably, the most complete treatment of the trends and developments in industrial arts education available. It provides many pages of up-to-date material on technology and how we in industrial arts can explore this rapidly advancing world for students in our country's high schools. We realize how vital is this keeping up with progress of our technological society; our problem is finding the key to the "how" of this keeping abreast of the new and improved. We hope this volume will assist industrial arts teachers in meeting this most demanding challenge.

Walter C. Brown
President

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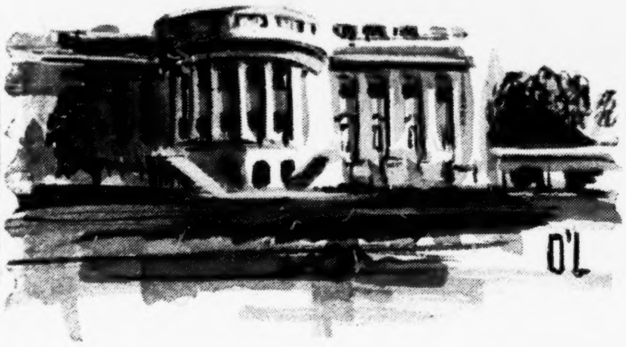
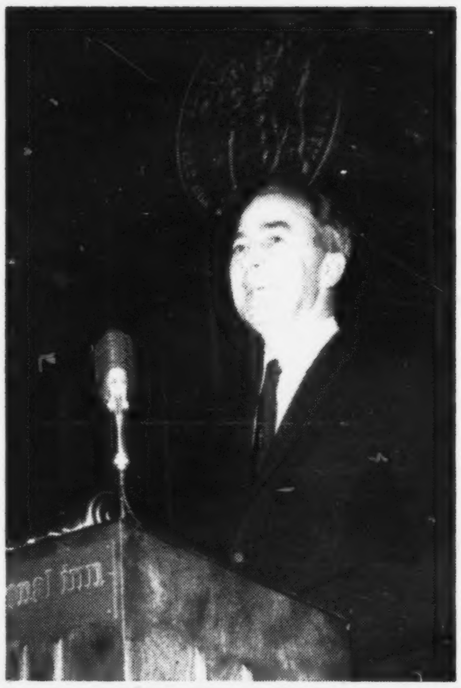
the convention in pictures

Full house. The 26th annual convention of the AIAA included many meetings that packed them in! Above is a scene at a general session; at right, a special interest session.



An important part of the convention was the teacher recognition awards, shown at right and below.



Speaker, speakers, everywhere. Above is keynoter Senator Eugene McCarthy (pg. 3); below, Labor statistician Ewan Clague (pg. 10); and below, at right, AIAA president Walter Brown.

From left to right: Walter Waetjen (pg. 26); Dr. Donald Maley (pg. 81); and the Rev. Ernest Eumarian (pg. 36).

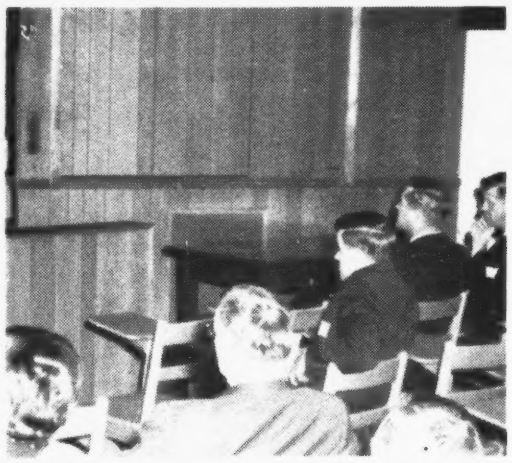
AIAA officers and staff members led the convention's proceedings. Above is Ken Dawson, executive secretary-treasurer, answering questions from the floor at a business meeting, while, below, Elizabeth Hunt, of Oswego and second vice-president, is shown presiding at a general session.

The special interest sessions were lively, with much informal before-meeting and after-meeting discussing of vital topics.

One of the student meetings.

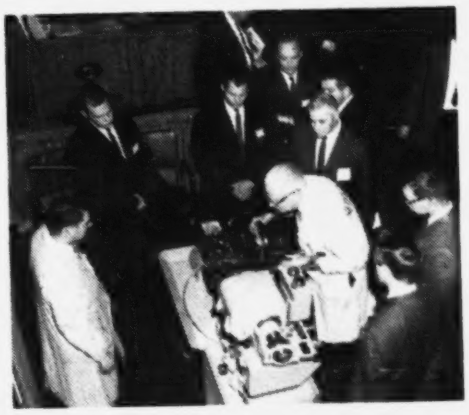
International Inn

A scene at the registration desk; about 2000 members, exhibitors, and guests attended this year's meetings.



International Inn

Traffic was heavy at the exhibits this year; at the left is a general scene, below a machine demonstration.



MILLERSVILLE
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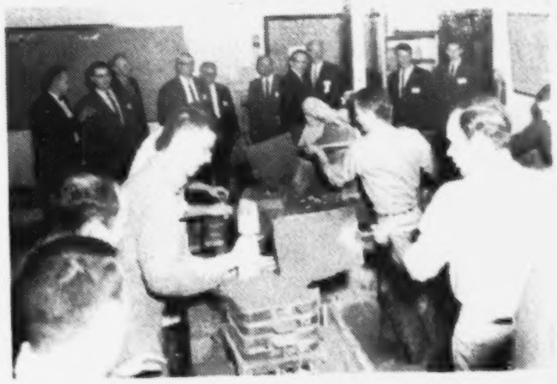
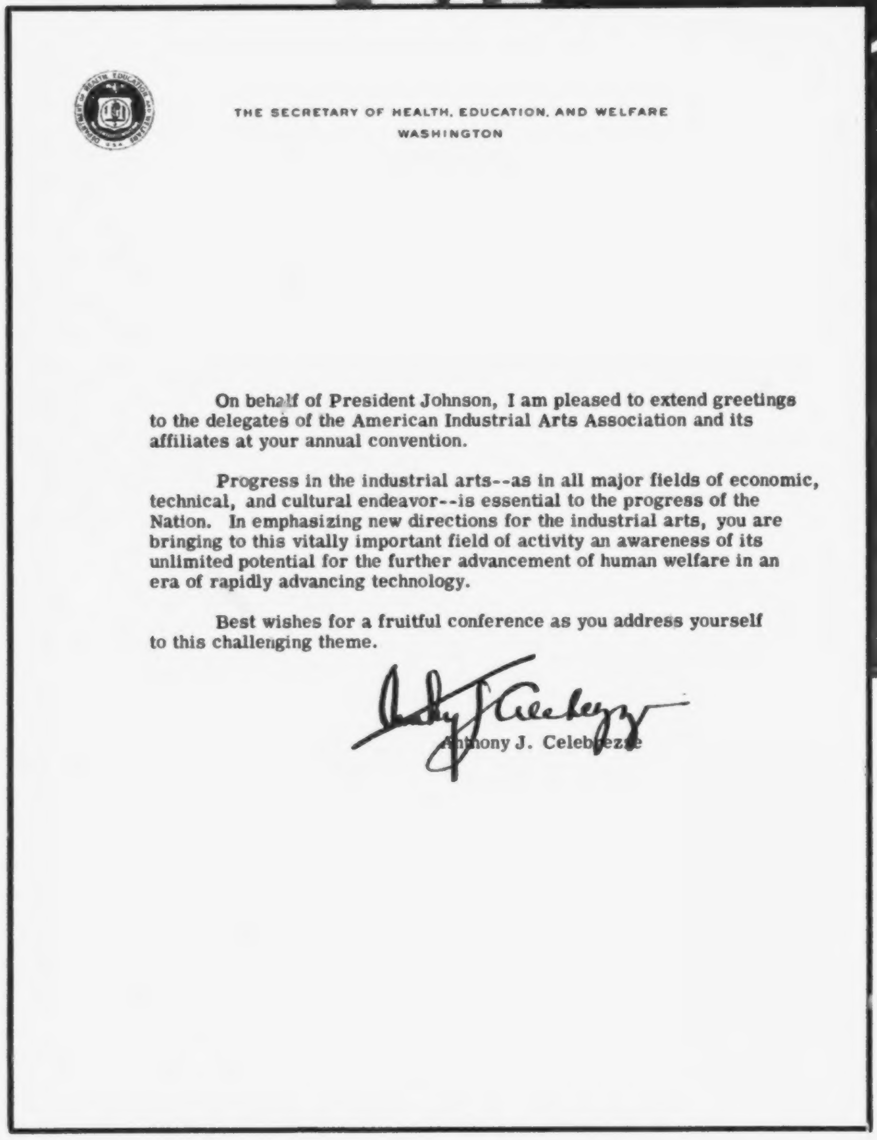
In addition to the commercial exhibits, I-A colleges displayed their wares.



The tours were popular, as this scene at the University of Maryland shows.

Before the convention officially began and at various times during the meetings, the executive board under the direction of President Walter Brown attended to the policies of the Association, and of industrial arts education.



THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE
WASHINGTON

On behalf of President Johnson, I am pleased to extend greetings to the delegates of the American Industrial Arts Association and its affiliates at your annual convention.

Progress in the industrial arts--as in all major fields of economic, technical, and cultural endeavor--is essential to the progress of the Nation. In emphasizing new directions for the industrial arts, you are bringing to this vitally important field of activity an awareness of its unlimited potential for the further advancement of human welfare in an era of rapidly advancing technology.

Best wishes for a fruitful conference as you address yourself to this challenging theme.

Anthony J. Celebrezze

Thomas G. Pullen, Jr.
State Superintendent of Schools
of Maryland

Greetings

IN my opinion industrial arts is a fundamental and necessary part of everyone's education. I am convinced that the big job of education is to bring into everyone's life a sense of beauty, a sense of perspective and proportion, and a sense of concern and obligation to one's fellowmen.

In one's own way of living, one finds the kind of happiness and satisfaction that God Almighty intended his children to have. No one in all the ages past, no one existing today, and no one in all the years ahead has lived, is living, or will live the life of another. Therefore it is highly important to any individual just what his education does for him.

I would like to mention only a very few attributes of the educated man and the part industrial arts should play to accomplish these ends.

First, every individual should have a proper regard for facts, for exactness, a practice of anticipating or planning, and a desire for ease and simplicity in work.

Secondly, I believe that industrial arts, properly taught, can develop a sense of beauty. Whatever is lovely is uplifting, and the purpose of education is to bring beauty into the lives of our youth in order that they may live more elevated, joyful, and satisfying lives.

In 1929, 35 years ago, there were few industrial arts teachers in Maryland outside Baltimore City. Along with my Superintendent in Baltimore County, another principal, and the state supervisor of vocational education, I spent a week or more in Cincinnati, Chicago, Waukegan, Gary, and other cities observing and studying the industrial arts program in the schools.

We came back from that trip committed to a program of industrial arts for Baltimore County. The following year we inaugurated a real program. Frankly, we raided Indiana, Illinois, and Ohio for several years for teachers. After they became used to the "Promised Land," they did the recruiting for the state school system.

I pay tribute for the first time before such an assemblage to those states which served as a guide to our state in the industrial arts field and which gave us such good teachers. Our great progress in this field is due largely to them.

EUGENE MCCARTHY
U. S. Senator
State of Minnesota

INDUSTRIAL ARTS AND ECONOMIC GROWTH

DR. Brown and Dr. Osgood, officers, and delegates at this meeting of the American Industrial Arts Association, and ladies and gentlemen. It's rather reassuring to a member of the Senate these days to have such a large audience. We. as you know, have the privilege of speaking without limit but we have great difficulty—well I was going to say in holding an audience—as a matter of fact, we have difficulty in getting an audience to be present when we start our speeches in the Senate these days. I was particularly pleased to receive this invitation and to be able to accept for a number of reasons. I remember that as a teacher those of us who worked in the so-called academic subjects, those of the general curriculum, always envied the industrial arts teachers because they seemed to lead a much more orderly life. It was possible for them to pass, I thought, a fairer judgment upon the achievement of their students, or at least to make a better evaluation of what had been achieved, whereas, we more or less had to cast them out of school into the future, hoping that somewhere along the way something we taught them might prove to be of value. and that we ourselves might have some knowledge of what we had accomplished. In politics, too, I think, we feel something of this same frustration that we never really seem to be able to achieve that completely kind of satisfactory act such as described in the statement, "At certain points you see a child beginning to learn, having recognized the joys of accomplishment." Now this is one of the limitations of politics and perhaps quite properly so, because it is not an exact science and it is not the whole of life really that at all times in government—I would not limit this to government—but certainly in government, we have at all times more responsibilities, more things that we would like to do and more things that we ought to do, more things that we need to accomplish than we have power or authority to accomplish. This is true, I think, in teaching also to a great extent. Perhaps, this is the very character of a free society and as long as everyone feels that his responsibilities run beyond his power, his authority, and run in many cases beyond his ability, at least this should be his disposition, then I think you can be reassured of a continuing effort and continuing improvement of our society. My topic tonight, "The Industrial Arts and Economic Growth," will be presented to you largely in terms of automation. There's a great deal of talk about automation. Automation is one of those terms, well they come along conveniently—at least they are convenient for politicians. They give us new titles and new topics for insertion in the *Congressional Record* and new titles for old speeches. This is true not only of politicians but I think that there are a few economists around the country today who are using automation in titles to old speeches which formerly were applied to or used under somewhat more limited titles. The sociologists, of course, have a new title and to some extent a new problem with which to deal. It doesn't mean that I'm against the new term. I think oftentimes a new term which is applied to an old or continuing problem which has some new aspects may be a very good thing because if it moves all of us who have responsibilities to do some new thinking about the old problem and to the extent that there are new elements and aspects to that problem, to direct some new attention and some new thoughts to those elements and aspects which are new. So far as automation and the great, the really great advance in technology, I don't mean to limit this to automation, but the great advance in technology, scientific knowledge, the application of that knowledge which has taken place, I suppose we'd say—at least as far as making an application of it in the non-military field. Since the end of World War II there have been opinions and views which have been rather extreme. On the one hand, there is the overly optimistic view that this new advance in technology is somehow the fulfillment of the promises. As a result of this advance all of the ancient problems with which mankind has to deal, that these had now been somehow brought under control and for the most part were matters of purely historic interest and we are now at the point of moving humanity from the low ground and in the valleys into the upland pastures where the sun shines all the time and all man's material needs can be met and will be met. On the other hand, there is the pessimistic view which sees automation and technological advance as a, well, heralding the end of humanity, at least the end of any kind of useful function or work on the part of most of mankind. It seems the need for human effort and for human response, the kind of response with which you people are familiar, that in which you have, inasfar as you can, a full expression of the basic attributes and characteristics of human beings, action and work in which our intellectual capacity is satisfied to some extent. Our capacity to make moral judgments is determined by our ability to distinguish between right and wrong in our work and actions and as we exercise our creative talents. The pessimistic view is that for the great majority of mankind this kind of response, intellectual, and moral, and creative, will be denied. Well, this of course, would be disastrous. It would be by way of denial of all of the ends and objectives which civilization has sought throughout recorded history. I think we ought to note at this point that man and society, I think, are perfected not so much by what is done in leisure time in those activities which are apart from what we call work, but that in every culture in which you had a great advance, the really constructive force, that force which has contributed the most toward the building of a better society and that the satisfaction of the people in that society has not been their leisure activities, that which they did in their spare time, but rather that the constructive force and the great building force has come from the work which was performed in that society and we need to be concerned that the development of technology and automation be not denied, but that rather we take these forces and this knowledge which is present to us and use it in the most constructive way in supplying the material needs of our society, and our society now is the entire world. But not only meeting these material needs, of bringing about economic growth and material growth, but bringing this about in such a way that the instruments of that growth, the men and women who work and who plan and develop, that they too are improved and perfected in that process.

Well, what about automation and technological advance and economic growth? Most of the economists, the theoretical economists at least, are inclined to take the view that automation must of necessity and technological advance, must of necessity result in economic growth. I think few of us would deny that this is almost sure to follow. Most of them assert without hesitation that production will be increased, but some go beyond that to say that some of the other economic problems which we have which are not related to the physical act of production itself, the problems of boom and bust, of business cycles and of unemployment, that these, too, will be solved in much greater measure than we have solved them in the past. Peter Drucker, for example, writing in *Harper's* magazine some seven years ago, said that he thought that automation and technological advance such as we are now experiencing would prevent the extremes of boom and bust since, he said, technological advance and the use of technology today requires a great investment in capital expenditures, and that these investments must be made independent of cyclical changes of the economy. In the same article he expressed the opinion that technological advance would stabilize employment since with it labor would more and more be in the nature of capital resource and wages would assume the character of fixed cost. Now this is the new economics of technological advance when labor, and for theoretical purposes I suppose it's alright to reduce labor and consider it as having the character of a fixed cost, but I would not want the teachers of industrial arts to come to look upon their students simply as potential fixed costs in the American economy. There is much more to be considered than that. Another professor, Clyde E. Dankard of Dartmouth, in an article on technological advance, automation, and employment, prepared in 1959, expressed essentially the same point of view. Moving more or less from the field of theoretical economics to the question of economic growth to that of the worker himself and of the artisan—as you know there are differences in opinion here—there are some who say that automation will demand greater and greater skill. a greater intellectual response for more and more people and that this work will be truly more creative, not just for a few but for many and that drudgery for all can be eliminated. And there are those on the other hand who say that work will become increasingly uncreative for the great masses of people; whereas work and drudgery in the classical meaning of that term as we have accepted it through the years—pick and shovel work, the hardest and most menial sort of manual labor—that these may be eliminated. But there will be a new kind of drudgery, a drudgery of the intellect. People will be deprived of the opportunity to exercise their intellectual capacity and creative talents. In effect, these people would say that what we will have are fewer people at the top being called upon to be more and more creative and more and more human and a great mass of people at the bottom who insofar as their work is concerned at least, will not have to be as human in the full sense of that word as they have had to be in the past. And some, moving on from this, would suggest that perhaps we have to accept that we will develop a kind of poverty class in highly industrialized society. A large group of people who really no longer fit into the productive effort of that society and I think all of us need to be concerned about the potentiality for such a development. In the United States today, for the first time in our history, we face the fact that in some of our large cities the same families have been on some kind of welfare through at least three generations, not three full generations, but three generations as they are brought close together, grandparents, parents, and children. And certainly if technogoical advance and automation were to encourage and give support to this kind of social structure in the United States, then we would have to raise serious questions about the desirability of technological and of scientific advance. Of course, none of us here would accept that this kind of development need take place. I think all of us would be resolved if that were a real threat, it should not take place. In any case, we do know that with the advance of technology, we are going to need more advanced technicians, more supervisors and more managers. We will need in the working force of these United States people who are better trained as technicians, and as engineers, and in the highest professional sense. Then, if this is to take place as it must take place, it's a problem which needs the continued attention of every one who is concerned with not just industry in the United States, not just about economic growth in the United States, but concerned about the whole structure of our society, about the culture of the United States itself. For any judgment concerning technological advance must at all time take into account two basic considerations. One, that of the economic effect in terms of material goods to meet the material needs of society, and second, a moral judgment. I don't mean to say that the first did not have moral implications because certainly to meet the physical and material needs of a society is an act having moral implications, but along with that, a moral judgment concerning the nature of work and the effect of work upon man as a worker and the consequences of that for the whole structure of society itself. If we were to accept that work itself was a kind of curse then certainly a fully automated society, a fully automated productive system would be wholly desirable, a kind of temporal salvation. But if on the other hand we considered that work which helps to make man also helps to make society then we could never put aside the consideration of technological advance, or scientific advance, or the application of science and technology to life itself from this second consideration. So I'd say that all of us, those who are in government, those who are in business and industry, must be concerned about the total problem and try to see it as fully as we can in all of its aspects and all of its implications, and having seen it as clearly as we can then move on to make some judgment about it. And certainly I think we would say that the basic responsibility, the application of science and technology, does rest with the industrial community of the United States since they are closest to it and they have the greatest power to act. We must expect them to share a great part of this burden of responsibility, to train new people, and to retrain old people. We have never accepted that society itself can escape responsibility. It's rather popular in political campaigns to say that government should do for the people what they cannot do for themselves or cannot do as well, but I think we ought to add—I hesitate to try to improve on Lincoln, but I think what he said was applicable to the particular problem he was talking about a hundred years ago—but times have changed and I would add to that, that sometimes government should act when people or institutions in society, whether its the educational institutions or whether it is the industrial institutions or the business and financial institutions or in some cases even the family, when they do not do things which they could do and which perhaps they might do better than government or government agencies. At that point there is a burden of responsibility which rests upon the whole of society to make up for deficiencies, to make up for gaps in the performance of other institutions in society, because our responsibility, the responsibility of government and of its agencies, is that of the general good. We can hope, of course, that when there is failure outside of government and when there is failure of other institutions, family or church, or school, that this may be a short life failure that by example and by direction, that correction may be brought about, but that in any case, a shared responsibility, shared in large by the industrial community itself, shared of course by the family and by the individuals who must take some responsibility upon themselves to respond to these changes which are taking place. In addition to that, a responsibility which you recognize and which I recognize which must be born by society itself and here primarily through our educational institutions, and I'm not going to tell you how important your work is in this effort because I know that you recognize it. I think it fair to say that your work is perhaps more important in the next ten, or fifteen, or twenty years than it has ever been in the past for these two reasons: One, because what might be called the mass or volume of changes which are taking place in our society today, changes which in many instances bear upon your profession, that the mass or volume of these changes is greater than it has ever been before. You could apply a kind of quantitative measure and this is a fact of current history; it's a fact to which we must respond. And the second difference has to do with the rate of change. Not only has the mass or volume been greater than it has ever been before, in regard to your problems we could expand this to include all the problems of mankind and certainly all of the problems of government because whereas there was a time when we could set aside really whole nations and whole continents and say these are not a matter for our concern, at least not now, these are not a part of current or contemporary history, we know that the reality is quite different and the same is true in a somewhat more limited scale in dealing with technological and scientific and industrial advances in the United States but there are more changes taking place, there are more problems which demand your attention and my attention and the attention of the people of this country. And the second difference is that the rate of change is more rapid today than it has ever been before and here again if we could look at the broad screen and talk about international problems we would have to acknowledge that the schedule on which we are called upon to respond as a nation is not really of our own making any longer. Whereas there was a time when we could say, well, Africa is a problem for the next century or Southeast Asia, perhaps in 50 years, and Latin America after the next presidential election—that was the usual timetable for Latin America. Now they are all here with us and the timetable and scheduling is not of our own making—in part it is made by our enemies—but I think more important it is made by the very movement of history itself. And the same thing is true in your profession and in your work. Changes are taking place, it would seem sometimes as if they were almost out of control, and you cannot or we cannot set them off for five or ten years or 15 or 20 but we're called upon to respond again on a timetable which has been advanced, a timetable, the making of which for the most part was out of our control. Well this is the nature of the total challenge to which all of us are called upon to respond. I think we must all resolve to agree to meet it in the fullest possible measure. The criticism of our industrial system, which has run throughout the history of our free enterprise industrial system such as ours and the free democratic institutions of government to support and sustain it, has generally run to three points. There has been the criticism that we could never master the problems of the business cycle. We had to have prosperity followed by depression. Well I think we have almost established that this need not be the case and that we can keep the general economy of these United States moving upward without an intervening depression, that we can move from a high level of economic production to an even higher level, that we can move from a high rate of production to an even higher rate of production without the intervention of recession and depression and recovery. We've been criticized, too, on the ground that the manner in which our industrial society operates must be such as to degrade the workers. This is criticism directed at our system. Well it has been directed at us for a long time but formalized really in recent times by Karl Marx and those who have followed his line but stated also by many other critics of the industrial system. I think we are called upon to prove that employment in an industrial society, in a highly technical society, need not in itself be degrading. We have proved it in some areas and we can prove it in others, but if we are to do so, we cannot really leave the determination and the outcome of this development to chance or to the operation of what are sometimes described as purely economic forces. And the third challenge which we face has to do with the distribution really of participating in the productive effort of our society. I think, as we approach this problem, there is at least one fundamental point that we need always to keep in mind. That many of our ideas and approaches to problems in the past and some of the institutions of law and of society were developed at a time when it was accepted that there was really not enough of material things to satisfy the needs of all people and that not enough could be produced to satisfy the needs of all people even in our own society or in western civilization, to say nothing of people throughout the world. Many concepts and institutions were developed on the assumption that there must be scarcity, not enough to meet the needs of people. Well this is not altogether true today, at least insofar as the United States is concerned and this would be true of the advanced countries of the world. At least we have a knowledge now, technology and science, a mastery over the physical universe, which should permit us to meet all the needs of our own people and beyond that we have a demand, a kind of conspiracy on the part of under-privileged, impoverished people throughout the world that some of these benefits and some of these blessings be extended to them. But in any case, a fact which we have never had to acknowledge in the past. In some areas the reality of producing enough to meet all the needs of the people for that particular material thing, but along with that the potential to produce enough to meet the material needs of people. So, we move from a base of adequacy if not of surplus, as we move on to the question of how to distribute. The two manifestations of our failure to meet and respond to this reality, one the fact of poverty and along with that the fact of unemployment. And I think that our effort must be, our objective must be to see to it as best we can that everyone who is willing and able to work has a job which is a challenging job, which is a constructive job, which calls for a human response on his part, and on the basis of that job, and of that work or of that professional activity at whatever level it may be. This is as much as you can expect of work and of industrial and of economic effort. This kind will never be entirely satisfactory, it will never result in complete happiness for all people, but insofar as we are able through our efforts, through the application of reason to human problems, we can say that to the measure that we accomplish this objective that we have developed a perfect society or that society that comes closest to perfection because through the conditions it established, through the institutions which are developed within it, we have not achieved happiness for all people because this involves something which is outside the control of government and of education and to some extent beyond the control and condition of society itself, but at least we should be able to say that we have established those conditions of life and work in which every person has been given the fullest possible opportunity to achieve his own individual happiness and own individual perfection.

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THE MANPOWER PROBLEM–SOME CHALLENGES FOR ALL LEVELS OF EDUCATION

AMONG the most urgent problems facing this nation are the education, training, and placement of the millions of young people coming to maturity in the next decade. We know that changes in the kinds of work people do have taken place, and that the future will see even greater changes.

What challenges for our educational system are implied by the changes we project in the occupational structure of the nation? Must we be at the mercy of the trends we see taking place around us? If we do not like the implications of the outlook which we see in the future, do we have the power to make changes?

I believe that we can make changes; within limits, we can shape the future. This is why it is important to study what has happened, important to make future projections, and most important, to take those actions which will make for a better future.

The education, training, and the career choices of the nation's youth are a vital concern not only to the young people themselves, their parents, teachers, and counselors, but also to business, government, community, and labor leaders.

Young people preparing for a lifetime of work need to know where the jobs are now, what kinds of jobs there are, which have the most promising future, and what education and training are required to qualify for the jobs they want. They need to know more—that industries and occupations are constantly changing and that they must be prepared to learn new skills and new ways of doing things throughout their working lives.

The average man—and the average single woman—may expect to work for 40 years or more. Even married women with children may expect to work for 27 years on the average.

The following highlights show some of the changes expected in the population, labor force, and over-all structure of American industry and how these changes relate to the employment outlook for young people. They also demonstrate how employment opportunities for youth and other workers will be affected in a variety of industries and specific occupations.

At the outset, I want to emphasize a note of caution. Judgments about future events are a hazardous business. We must always keep in mind certain basic assumptions. They are as follows: continued high levels of economic activity; further scientific and technological advances; and no major wars or depressions, but no fundamental change in the current international situation.

In looking forward to the decade of the seventies, the first question we must ask ourselves is "where will the jobs be found?"

Between 1960 and 1975, we estimate that non-agricultural industries may add as many as 20 million workers, about 15 million in the service-producing industries, such as trade, government, transportation and public utilities, and finance, plus 5 million worker in goods-producing industries, such as manufacturing, construction, and mining. Within these broad groupings, there will be many cross-currents; some new industries will grow swiftly and some old ones will decline.

Woven through these major industrial changes will be some significant shifts in occupations. What changes can be expected in major occupations during the next decade?

In general, our studies show that the opportunities will increase the fastest in those occupations requiring the most education and training.

This means that the largest increase will be in professional and technical workers and also in clerical workers; in fact, in white-collar occupations generally.

In the blue-collar group, employment will increase faster among craftsmen and other skilled workers than among operators, and there will be no increase at all among laborers. The large and miscellaneous group of service workers will expand greatly, while the number of farmers and farm workers will decline.

How many people must be trained to meet the nation's needs? What do these projections for education and training imply?

First, we must bear in mind that training needs depend not only upon the growth of the economy but also upon the replacement of people who retire, die, or leave the work force for other reasons.

Indeed, in some occupations, elementary school teaching, and tool-and-die makers, for example, replacement needs will far exceed the number of workers required for net growth.

For the economy as a whole, 13.8 million will be needed for net growth between 1960 and 1970; but an even greater number will be needed as replacements.

We are this year on the threshold of a great wave of young people reaching maturity. In 1965 the number of young boys and girls reaching age 18 will be a million larger than this year; and that new annual level will be subsequently maintained for the next decade.

Age 18 is the year of decision for most young people, who must then decide whether to go on to college, seek other kinds of training, or begin their working career. Many young people in this age group are already in the labor force: among young men aged 18 and 19, 35 percent of the students and 92 percent of the nonstudents are working or looking for work. Students usually are part-time workers.

How well prepared are these young people for the world of work? So far as education is concerned, they will have a better basic education than any similar group in the past.

By 1975 we estimate that there will be over 8 million in college and over 16 million in high schools, numbers so large that effective planning and strenuous efforts will be necessary to prepare the teachers and provide the facilities that will be required.

In terms of proportion, 7 out of 10 young workers entering the labor force during the 1960 decade will have a high school education or better, compared with 6 out of 10 in the 1950's. Six and one half million will have an education beyond high school, as compared with 4 million in the 1950's.

Nevertheless, in view of the changes which are in prospect in jobs and occupations, the fact that 3 out of 10 new entrants into the labor force will lack a high school education presents a special challenge to communities, schools, parents and employers.

In absolute numbers, 7½ million will have had 3 years of high school education or less. Of these, 2 million will have only an 8th grade education or less. These sheer numbers will create keen competition for entry jobs. The actual shrinkage in the kinds of jobs that can be handled by people with little education will make the situation serious for these young workers.

Considering the legislation that has already been passed, plus that which is still under consideration, it looks as if we may have the tools that will be needed to tackle this problem. But the job itself will have to be done by the educators, counselors, and the rest of us who work with young people. Our responsibilities will be greater than ever before. It is up to us to remake the future.

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New Pressures—And Old

THERE are certain key features of national, regional, provincial, state, and local school systems which reveal, or perhaps I should say, betray the fundamental weaknesses or strengths of the total educational enterprise. Among these features, one of the most important is the way in which the system responds to pressures.

To what kinds of pressures is it particularly sensitive? Does it react to them in terms of a broad policy held over a significantly long time or in terms of transitory responses narrowly conceived and carried out in fits and starts?

At the present time the people of the United States believe they are in educational difficulties. I think they are right; they are in difficulties. All the people of the world are in difficulties, although many of them are not advanced enough to recognize the educational nature of those difficulties.

The Americans are sufficiently advanced, however, to know that they are in educational difficulties, but not advanced enough to know what the difficulties are. Many of them think they know. They think their difficulties are caused by personnel and material shortages, a lack of teachers, buildings, facilities, and money to supply them. In fact, however, their educational difficulties come primarily from a shortage of beliefs.

The Americans do not know what they want education to do, and so they focus their attention mainly on educational motions, processes, content, and methods without much concern for purposes. This makes it easy for them to travel in circles, educationally speaking, when put under sudden pressure. They whirl easily because they lack a basic belief to give them solid anchorage in educational matters.

Much of the American concern about educational methods and programs is centered on secondary education. The ordinary citizen does not like to look critically at the elementary school. He is brought up in a culture in which love for children and dogs is second only to reverence for Mother and the Flag, he finds it hard to criticize an institution which performs so many child-development, child-welfare, and child-protective functions as does the elementary school.

Higher educational institutions, tend to overawe the American layman. For every situation, they have language that subdues him. If he is not himself a college graduate, he assumes that he lacks the schooling to understand that language.

If he is a graduate, he knows he cannot understand it. In his undergraduate days he heard about scholarly disciplines, humanities, liberal arts, and basic scientific concepts, but it was all he could do to get through Zoology 5, Political Science 11 and 12, and those other courses his adviser and the dean made him take. He almost flunked Physical Education 1 by not being able to meet the required standard in push-ups.

When pressure is put on the whole program of schooling, moreover, the college and university authorities often turn accusing eyes on the secondary school, and the elementary school people look confidently at their solid floor of concern with child development. In this situation, the average layman turns his critical attention on the secondary school, and his reactions are in terms of methods and subjects.

He can say as enthusiastically as though he knew the facts, "Industrial arts? Ha! They may be all right, but it takes solid courses in mathematics and physics to develop missiles. Home economics, art, music, driver training? Very nice, if you can afford them, but chemistry—that's what makes the Communists squirm."

After the Soviets put up their first sputnik in the fall of 1957, the Americans circled around one chief area of subject matter, mathematics as related to physical science and weaponry technology. They increased the pay of secondary and higher teachers in those subjects, while taking due care not to compete with the industrial and government pay scales.

At the same time there were frenzied appeals from various pundits to make our children work harder. As one result over the past six or seven years we have had in many elementary and secondary schools marked increases in homework assignments.

We have the ironic situation in this country of trade unions having forty-hour work weeks and talking confidently of thirty-hour weeks to come, while the children have fifty- or sixty-hour work weeks.

A citizen who spends $200 for power steering on an internal-combustion monster covered with chrome, all of which he needs about as much as he needs a Diesel locomotive, will scream at an additional $20 per year of school taxes. He will spend $400 per year for alcoholic beverages and cigarettes and vote resolutely against a bond issue for new school buildings because it would cost him $40 per year.

In the 1964 edition of DeYoung and Wynn's *American Education,* the authors speak of "a popular magazine of wide circulation . . . which sought to deal in a special article with the so-called crisis in education. The remainder of the issue had five pages of beer, wine, and liquor ads, four pages of cigarette and cigar ads, three pages on cosmetic and deodorant ads, and three pages on horse racing."

The outcome of this kind of circling around subjects, with no central belief to anchor the American educational efforts, is not hard to predict. As more and more of the educational functions are abdicated to non-school agencies, as attitudes are formed by mass media of communication, and as hucksters systematically teach the opposite of many phases of the school curriculum, profound effects on educational achievement become apparent.

The school is asked to teach its pupils to think independently and critically, while the adult community uses slogans instead of reasoning and labels instead of argument. Political decisions become merely questions of the relative popularity of personalities. Personal images are built up or broken down by advertising techniques. Instead of making economic choices, consumers respond to subliminal suggestions.

In artistic and moral judgments the Americans follow similar patterns. Questions of taste and ethics are answered automatically by agencies of the mass culture. The people who control these agencies, moreover, become less and less competent to make aesthetic or moral choices. We may well modify Lord Acton's famous dictum about power and say, "All conformity corrupts, and absolute conformity corrupts absolutely."

Against these developments of circling culture, how can a people find and agree on a central belief to which all their schooling can be tied?

I believe the citizens of the United States of America can find this belief in their history. Here is a nation which was born in the rattle of revolutionary gunfire. Its national birth was announced in the noblest language of the eighteenth-century enlightenment, listing the inalienable rights of the individual citizen. It fought the most devastating civil war in the history of the nineteenth century to clarify and guarantee those rights for a poor, weak, and recently enslaved minority of its people.

It won the status of a great power in the first half of the twentieth century as it fought again and again against tyrannies of whatever composition that sought to take these rights away from any people.

This, to us Americans, is and of right ought to be the greatest of human causes. It is our American cause, the cause of individual human freedom. It is and should be the heart of our national belief. We should organize our society around it. We should build and man and operate our schools in accordance with it.

When it is challenged by opposing doctrines we should support it and strengthen it with every peaceful measure and instrument in our command. If those peaceful measures and instruments are not enough and if the drums of war roll again, let us not be mealymouthed about our willingness to draw steel and strike again for our great American cause as our fathers did before us. And when in behalf of this cause we sheathe our weapons again, let it be for lack of argument. Let us make this clear to a candid world.

In the service of our national belief and its necessary processes of popular rule, let us organize and operate our educational systems to provide every citizen with the maximum opportunity to make wise choices in all the areas of public and private concern. Let us try to give him the greatest possible freedom to develop his abilities to the utmost in service of himself and his people. Let us do this with regard to the needs of our people for the informed and disciplined freedom that we have envisioned.

An educational organization centered around and anchored on this kind of belief in individual freedom must of necessity be centered around well-developed guidance and counseling systems.

The teachers in such an organization will base their programs on their conviction that every learner is unique. They will study him with care, with precision, and with scientific dedication to discover and understand his motives, interests, and abilities. They will build their methods of instruction around what they know about the individual learner.

As a result they will have more real discipline in their teaching than is ever dreamed of under the aegis of minimum curricular standards. Those are the standards which often exact little effort from the ablest member of a class and then praise and reward him for doing practically nothing.

Those are the standards, furthermore, which often ask the slower student to do work that is impossible for him to accomplish. Under the direction of the teacher who knows his pupils' real abilities, such minimum standards will be replaced by a scholarly discipline which is applied to the individual learner in terms of his capacities. Its ideal is a 100-per cent performance in every subject for every student.

Is there not some middle way between the old cautious, circling educational approach, giving way to pressures here and there, and this disciplined approach anchored to the belief just described?

The answer is no. There is no middle way.

A country can go to educational hell on the middle way just as easily as on the wrong extreme. What it must do to be educationally saved is to have faith in its foundational belief and act upon that faith.

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IDENTIFYING THE STUDENT'S UNIQUE PATTERN OF TALENTS

PROJECT TALENT is a large-scale, long-range educational research study on the identification, development, and utilization of human talents. The study is being jointly conducted by the American Institute for Research and the University of Pittsburgh with support from several government agencies including the United States Office of Education, the National Science Foundation, the Office of Naval Research, the National Institutes of Health.

Recent national developments have made it necessary to find out just what talents American youth have and how we as a nation can help each student to identify, develop, and utilize these talents fully. It was decided that the best way to determine the answers to these questions was to survey a representative sample of high school students and to follow them up to discover what opportunities the students had to develop and use their talents in subsequent educational and vocational careers.

In March 1960, a five percent random sample of all students in grades nine through twelve in all public, parochial, and private schools, a total of 440,000 students in 1,353 secondary schools throughout the nation, were given a two-day battery of tests. These tests were developed especially for Project TALENT and included aptitude, achievement, and personality tests as well as a *Student Information Blank*, an *Interest Inventory*, and a *Student Activities Inventory*.

Approximately 2,000 items of information were collected on each student. The results of the tests based on information learned both in and out of school, plus interest inventories, and background information will be matched with data provided in follow-up studies which we plan to conduct one, five, ten, and twenty years after the students graduate from high school.

At present, three of the classes in our sample who were in the 10th, 11th, and 12th grades in 1960 have graduated from high school and have received the first questionnaire, the one-year follow-up. The high rate of responses from the students in returning these follow-up questionnaires to us has been most encouraging. About 70 percent of the seniors of the class of 1960 responded to the first one-year follow-up survey. Follow-up questionnaries from more than 125,000 students who were in the Project TALENT sample in 1960 have now been received.

Although it will take many years before all the information and data on Project TALENT is processed and analyzed, we do have some preliminary analyses which have important implications for education.

For example, it was found that there are wide individual differences in the abilities and educational achievement of the students in high school as evidenced by the fact that 25 to 30 percent of the ninth grade students already know more about many subjects than the average twelfth grade student.

The top five percent of the students in a grade can learn the English meanings of twice as many foreign words as the average student can in the same period of time.

We also noted some variation in scores on tests of achievement for students from various parts of the country. Students in schools from the Northeast tended to score slightly higher than average, whereas students from the Southeast tended to score slightly lower than average. The differences were not large, however, and we found students with both high and low scores in all parts of the country.

An analysis of the data collected indicates that a measure of how much students have learned prior to entering the ninth grade is a good predictor of how much they will learn in the four years of secondary school. It was also determined that this, in turn, is closely related to educational backgrounds and occupations of parents.

One of the objectives of Project TALENT is to provide guidance counselors with a comprehensive counseling guide indicating patterns of aptitude and ability which are predictive of success in various careers. This type of information would help to assist the student in interpreting his test scores on various aptitude tests, his interests and other characteristics in the light of his own potential.

This type of information along with information about family background, hobbies, reading habits, activities, and plans can enable the counselor to provide more meaningful guidance based on the student's individual pattern of aptitudes and abilities. There would be opportunities for students to make more realistic educational and vocational plans and to move toward the successful completion and realization of the goals they set.

In order to assist students in understanding the meaning of their scores on various types of tests and in the completion of various types of course materials, grades and scores should be presented to them in meaningful terms. For example, if a student's objectives and measures of progress in reading comprehension are to be meaningful, then he should be given information about the nature of the materials he is able to read and understand.

Recent work on Project TALENT provided some meaningful insights into the area of reading comprehension. It was found that reading comprehension can be stated in terms of the types of materials which students read and undertand such as the fact that slightly less than half of the 12th-grade students understand the subtler points in typical paragraphs from the writings of Sinclair Lewis, Jules Verne, and Rudyard Kipling.

Fewer than 28 percent were able to read and understand the writings of Thomas Mann. They also missed many of the points in typical articles such as those in the *Saturday Evening Post, Reader's Digest, McCalls,* and *Time*, and only 28 percent were able to read with comprehension selected articles in such magazines as the *Atlantic Monthly* and the *Saturday Review*.

Once both student and teacher discover the nature of deficiencies in such areas as reading comprehension, it will be possible to develop programs to assist the student in making better progress in reading and in other areas where there appears to be difficulty. When scores are presented in meaningful terms such as those given above, it is possible to provide much more meaningful counseling to students in the light of remedial programs to improve competence, and in considering the matter of establishing realistic goals and future plans for educational and vocational careers after high school graduation.

It was found that an analysis of the plans of the boys and girls in the Project TALENT sample showed that they set unrealistic goals for themselves. The survey showed that more than 62 percent of the twelfth-grade boys selected occupations which require a college degree.

It is known that only a few more than a quarter of these students will actually graduate from college, therefore there is clear implication that their occupational choices are not realistic. This can be seen from the changes in plans noted in responses to the first one-year follow-up questionnaire, one year after graduation from high school as compared with the choices students made while they were seniors in high school.

About half of the 12th-grade boys in the Project TALENT sample who graduated from high school in 1960 did not go on to college. Some indication of the aptitude pattern of the various jobs which students entered their first year out of high school is provided by an analysis of the first one-year follow-up study.

The test scores of boys engaged in electrical and electronic work, for example, were substantially above the average of the scores for all the twelfth-grade boys, including those who went on to college, on such tests as mechanical reasoning, visualization in two- and three-dimensions, and creativity. These same boys scored somewhat higher than average on reading comprehension, abstract reasoning, arithmetic reasoning, mathematics, and object inspection. However, these boys tended to score somewhat below average on the English tests and on clerical checking.

Data analyses on Project TALENT have served to emphasize a theory which has developed steadily since World War II. That is that the unique pattern of aptitudes of individual students is often inadequately used. Prior to World War II there was much emphasis on the concept of general intelligence based primarily on verbal and mathematical skills.

This was a single dimension of intellect which has now been outmoded by the multi-factor aptitude classification approach. This new approach was used in identifying Air Force applicants with aptitude for three different types of aircrew jobs. Each job differed in the basic aptitudes needed for successful completion of training. Those men whose aptitude patterns were predictive of success in the job of pilot differed markedly from the men whose aptitude patterns were predictive of success as navigators.

Tremendous gains can be made in the proper utilization of manpower if we can adapt selection procedures to the multi-factor aptitude approach and place men in the fields most appropriate to their individual patterns of aptitude.

Instead of attempting to draw engineers, businessmen, teachers, and scientists all from the same top ten percent in academic aptitude, the new approach makes it possible to identify many who might not qualify at the highest level in one field, but who do qualify in other fields.

There is, of course, quite a bit of overlap, but for many fields, there is an increase of about five persons in each hundred who qualify in the top ten percent in a second field who do not qualify at this level in the first. By adding the number of qualified persons in the second field, we increase the number of qualified persons from ten to fifteen in a hundred. Although adding a third field to these two does not represent quite as large a net gain, it should be possible to place a very substantial portion of the nation's young people in the fields for which they are outstandingly well qualified once we are able to determine the specific requirements for each field. This, of course, assumes that each student uses this information in making his educational and vocational plans.

One of the principal goals for Project TALENT is to define the patterns of aptitude essential for effective participation in each of hundreds of occupations.

Once we are successful in identifying the job elements peculiar to various kinds of jobs, both those requiring college education and those which do not, counselors should be able to offer better guidance to each individual student by helping him to relate his own unique pattern of aptitudes to the kind of educational program he hopes to pursue following high school graduation, and to the kind of job for which he hopes to qualify in the future.

Better use of the individual aptitude patterns of our youth should lead to happier, more productive, more satisfied, and responsible citizens.

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INDUSTRIAL ARTS EDUCATION: A VIEW FROM THE OUTSIDE

TO an outsider, you represent a potent force on the American educational scene. In 1960 almost 33,000 teachers were certified to teach industrial arts.

What is an industrial arts teacher? My hunch is he is a combination draftsman, woodworker, metalworker, electrician—a multitalented person, a sort of jack-of-all-trades and master of none.

Looking at practice, however, shows that industrial arts teachers find a more specific niche. They spend their careers in auto mechanics, drafting, woodworking, etc. One might conclude they are master-of-one-trade and not a jack-of-all-trades.

Perhaps you are "men in the middle."

Those of you who work with younger children in elementary or junior high school grades, you are more of the general educator. Those who work in the upper levels of the junior high and at the senior high level are much more of the vocational educator.

The industrial arts curriculum in the upper grades of elementary school and the junior high school should be designed to help youngsters develop those particular skills and attitudes that can only be developed in a shop or laboratory experience.

The early years of the industrial arts curriculum need to be general and broad. I am not at all certain there need to be formal classes in industrial arts education at this level.

I am not sure there is a need for an elaborate shop or laboratory to facilitate industrial arts instruction. Perhaps the best way to integrate industrial arts is to use a versatile industrial arts generalist who works with teachers, classes, groups or individuals in applying the features of industrial arts to the other areas of the curriculum.

What about the industrial arts teacher in the high school? My hope for the generalist still prevails. Do we need woodworking, metalworking, electronics, auto mechanics, arts and crafts, ceramics? I think not.

Why not return to the general shop arrangement in the school? By general shop, I mean a facility that has equipment to work with wood, metal, electronics, etc. Such a shop can exist and in some places it does.

The industrial arts teacher should be a part of a teaching team that would have responsibility for all the instruction in the preparatory sequence.

Let us rid the curriculum of such courses as "shop-related mathematics," "shop-related English," "shop-related science." Let us have the shop relate to mathematics, to science, and so on. We need to blend general education with the prevocational education.

One of the first problems in the education of industrial arts teachers is how to find a way to keep them in teaching. As I understand it, something like three out of every four beginning industrial arts teachers eventually leave teaching for the fortunes of the business and industrial world.

I would suggest that a teacher first should be prepared to be a professional. What about the specialized courses that prepare the individual to be an industrial arts teacher? First, I hope they are cut to the bone.

Teacher education courses should be developed in such a way that many discreet courses could be designed and taught in ways that clearly show the relationships of one to the other.

All industrial arts teachers-in-training should be required to spend at least one-half year on a full-time basis in a school apprenticing under a superior industrial arts teacher. This is hardly a new notion, but it should be a real full-time training activity.

Institutions training industrial arts teachers need to do a considerable amount of work to improve general education, to cut down on the proliferation of over-specialized courses, and to improve the internship or clinical phase.

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A NEW LOOK AT METHODS AND TECHNIQUES IN TEACHER DEVELOPMENT

By concentrating on improving the techniques of teachers, we could revolutionize the learning-teaching process in all education institutions in this country. Teacher training institutions spend too much time on "so-called" methods of teaching. They spend too little time in the development of techniques of teaching.

Since we have made some strong general statements regarding methods and techniques of teaching, let us show the differences in the two and what can be done to improve them.

Methods are plans, systems, and orderly procedures employed by teachers to help students learn. The three common types are the telling, showing, and the doing methods.

They are relatively easy to teach because the procedures and processes are set. Too much effort is spent on the theoretical types of methods courses. Approximately 80 to 100 classroom hours should be sufficient to teach the various methods, provided that no more than 20 per cent of the time is devoted to theory. Eighty per cent or more should be devoted to practical application on how to use the methods.

Techniques of teaching are concerned with the actual performance of a teacher, including his personal characteristics, mannerisms, personality, attitude, desire, enthusiasm, appearance, planning, etc. These are more involved than methods, and far more difficult to teach.

They can be developed by providing student teachers with plenty of opportunity to practice various techniques "on each other" followed by much analysis and constructive criticism from class members and instructors.

It is not the intention of the writer to downgrade the importance of subject-matter knowledge on the part of every teacher, but to show that more stress should be placed on the development of techniques of teaching. If more effective "approaches" were used in methods training, we would get a better-trained teacher in the typical American classroom.

Before we can go into a more-detailed discussion of how methods and techniques should be improved, we must get a better understanding of the difference between learning and teaching.

Teaching is getting others to follow a preconceived course of action. This means teachers must have a carefully prepared lesson plan, based upon a carefully prepared program of instruction. This is a very serious deficiency in our educational process today.

Learning, on the other hand, is an active process where a change of behavior must take place. When this occurs, a mental image is developed regardless of whether it is a simple mathematical problem, a complicated concept, or a most difficult statistical analysis. Every person's mind is nothing more than a filing cabinet of clear or hazy mental images that have been put there from the time of birth until the present.

Before a teacher enters a classroom, he should know that there are four types of learning: appreciation, knowledge, technique, and skill. He has to decide which type he wants to take place during a period of instruction.

Before a teacher can employ methods and techniques properly, certain factors and conditions that promote learning must be recognized and understood. The most effective use and selection of methods and techniques will not work if the following factors are overlooked.

There must be a favorable learning situation. The teacher must consider such things as comfortable chairs, adequate lighting, freedom from distraction, temperature, humidity, ventilation, and the multitude of things that are related to establishing a pleasant and favorable learning situation. Without this, the best methods are doomed to failure.

Meaningful units are necessary. A program of instruction should guide every teacher in laying out each unit or block of instructions. The teacher and the learner should know the objective and learning outcomes for each unit or segment and should be able to visualize this segment when it is completed.

One of the big dificiencies in teacher training today is that for three and a half years prospective teachers are exposed to theory of teaching and for the last semester, they are exposed to practice teaching for the first time. They need distributed practice in teaching for the four years.

This does not mean they should teach children for the four years, but they should employ the various methods and techniques of teaching, under instructor supervision, by practicing with each other.

People learn more by their own responses and participation than by the responses and participation of others. If a good teacher is to be developed, he must have plenty of opportunity to appear in teaching situations. Then he must be analyzed and criticized until he knows his capabilities and deficiencies.

There are five avenues through which clear mental images can be established. These avenues are through the five senses, which are hearing, seeing, smelling, tasting, and feeling. By using audio-visual aids the instructor can be assured that the senses are being employed.

Every teacher must be conscious of the importance of letting each learner know how much progress is being made. Great teachers make every effort to establish a "confidence level" by giving the student a true objective and constructive indication of his progress.

We have learned from the preceding that many problems face a teacher before he reaches a decision as to the methods he should employ. If he employs the lecture method, rote learning may take place, student initiative may be stifled or students may be bored because they may already be familiar with much of the material.

Conversely, a pure conference, or even a directed discussion, will lead nowhere unless the students possess the fundamental knowledges, techniques, appreciations or skills required to discuss the problem intelligently.

The selection of the method of instruction to be employed must depend largely on the existing background of student information at the time the lesson is to be conducted.

Techniques are more involved and difficult to teach. In order to teach techniques, you must work on the personality, the attitude and the total make-up of the teacher. This writer cannot hope to cover the whole area of techniques. Only one important area, speech techniques, will be presented.

It takes two things to have effective speech techniques. They are clarity and an interesting manner. Clarity is the area concerned in producing clear, easily-understood speech—in short, the mechanics of voice production. The second involves that bond which is established between a good teacher and his class.

This bond is the result of careful preparation of lesson material, followed by a presentation that is positive, dynamic, and attention-demanding. In short, it is known as an interesting manner of presentation.

An interesting manner of presentation is achieved by physical, vocal, word and contact vitality.

The only way to develop speech in teachers is have them get up in front of groups, analyze and reanalyze their performance and give them continual constructive suggestions to improve. There is no secret to the development of effective speech techniques. It takes good, practical application, over and over again until effective speech is developed.

Every teacher must be aware of the difference between methods and techniques of teaching. Every teacher must know what learning and teaching really are. Every teacher must know what factors must be present in a learning situation before methods and techniques will work effectively.

Furthermore, teachers must bring pressure to bear upon every teacher training instrution to revise their curriculum and reorient every teacher training staff in the United States regarding the importance of good methods and techniques in teaching, placing more emphasis on techniques training and putting more emphasis on practical application or practice teaching in every teacher training curriculum.

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RESEARCH DEVELOPMENTS IN LEARNING: IMPLICATIONS FOR TEACHING

PEOPLE learn only if they wish to learn and they learn significantly only those things that are involved in the growth of self.

In the process of growing up and experiencing, a child has many contacts with varied aspects of his environment. These "contacts" become incorporated into his cognitive structure. This structure is much like a private map that the individual has of his world. Even more important is that each of these aspects of the cognitive map have valence to the individual.

That is to say, some aspects have positive valuation while others have negative. Those having positive valence are "closer" to the individual in his cognitive structure, while those with negative valence are more distant.

The organism depends on stimuli for information about the environment and then one's motor behavior is guided by the information. What is learned is more than information and more than simple motor behavior. The learning has been perceptual-motor.

A child uses his cognitive map to make predictions from the past to the present situation. In so doing he assumes the present environment to be identical or highly similar to what it was in the past.

What must be emphasized is that the individual is actually making hypotheses about the stimuli that he will be receiving. What happens if the anticipated stimuli are not encountered?

It is probable that the organism doesn't expect or anticipate that the present situation will be identical to those of the past. The young child may make such predictions from his cognitive structure, but with increased experience it would be anticipated that there would be change. Thus, the anticipation of change is partially an experimental matter.

We learn to know and to respond to recurrent regularities in our environment by skilled and patterned acts, using imagery, and through the use of language. If we are to benefit from recurrent contact with regularities in our environment, we must represent them in some manner.

We cannot dismiss this problem as "memory." The most important thing is not so much the storage of experience, but how experience is processed in the individual so that it may be usable and relevant when it is needed. Thus, it seems that an individual not only learns to know, but he learns to know in different ways.

It is not too uncommon to find teachers who assume they are able to transmit curriculum content to the cognitive structure of a pupil. This assumption means we can teach directly, that nothing intervenes between what the teacher teaches and what the learner learns.

To assume this means, also, that the cognitive structure of the teacher determines what the cognitive structure of the youngster is like at the instant instruction begins. It is believed that if the teacher makes the curriculum content "interesting" by a few audio-visual devices or by introducing a note of excitement in his voice, the children will be motivated to learn.

Recently a number of experiments have demonstrated that if the material to be taught to youngsters is already similar to or contained in their existing cognitive structure, learning is not facilitated. Instead of engaging in learning activity, it is likely that verbal behavior will increase, that motor activity of a random nature will increase, and that the person will become increasingly unable to give attention to specific ideas.

In this instance there is practically 100 percent match between what the teacher is attempting to teach and the pre-existing structure of the cognitive map. That situation, which we shall call 100 percent match, is an enemy to learning.

A situation of "mismatch" has elements which the learner does not know. This results in arousal of conflict with a consequent need to assimilate or articulate the unknown, incongruous, or unfamiliar material into his cognitive structure. To do this he engages in exploratory behavior. He will probably ask questions.

It is altogether proper to speculate as to who asks questions in the typical classroom situation. The usual classroom situation is one in which teachers ask most of the questions.

This is indeed a paradox for it should not be the teacher who is seeking knowledge by question asking. Herein lies one implication of this discussion: teachers must begin to re-examine the matter of who asks questions in the classroom and the type of questions asked.

Occasionally a teacher will attempt to get children to learn something, by presenting them with a vast array of entirely new and different kind of material.

In a well-intentioned but misguided attempt to get the children to reach out for this new information the teacher is inclined to place a wealth of material on bulletin boards and in strategic places around the classroom.

Literally, the learners are bombarded with new stimuli. This teacher is chagrined on finding the learners do not respond as anticipated and may even resist this seemingly rich learning environment.

In this instance there is too great a mismatch between the known or familiar and the material with which the youngsters are confronted.

The learner is aware that he should be able to articulate the curriculum content with his present knowledge. But, he is equally sensitive to the fact that he cannot do so and therefore he becomes anxious about the matter.

To cope with this situation the learner may engage in a variety of withdrawing behaviors. He may withdraw from the conceptual material as well as the classroom activities by being a gross dilettante in work production or by daydreaming to the point where the classroom situation passes him by.

On the other hand, he may physically withdraw by virtue of cutting classes or being a truant. These behaviors are apparent to teachers and are decried by them.

The second way of handling unassimilated information is more insidious and should cause teachers to be introspective. In this instance, the learner abandons his usual strategies for admitting information to his cognitive structure.

In abandoning these strategies he lowers his standards for admission of information into the cognitive structure. Instead of integrating simple facts into higher levels or organization the individual holds them at a lower level.

What is unfortunate about this type of learner is that he is often judged to be at least an adequate and maybe a good learner because he is able to retain facts even though not able to integrate facts within the cognitive structure.

By lowering the standards for admission of information to his cognitive structure, he has himself in a position where he is functioning at a much lower level in his learning.

The second point about learning is that every person has an image of himself as a learner and he behaves consistently with that image. To learn, every person must have a sense of group possibility. Children must feel they have a possibility of growing, of learning, and of being able to handle whatever it is that is placed before them.

A study done by Spaulding sought to determine what impact one's image of himself as a learner had upon his scholastic performance. Two groups of children were selected. One group had high ability and a second group had low ability as measured by one of our usual intelligence tests.

In each of these groups a test was given that got at their image of themselves as a learner. After this initial groundwork was done, a battery of achievement tests were given the pupils.

It was found that the boys who scored highest on the achievement test battery were the ones who had high-self images as learners regardless of intelligence as measured by the intelligence tests.

This was especially true of two particular areas on the achievement battery. One of those was in work study skills and the other, reading. A youngster who had low ability but high-self concept did better in reading than a youngster who had high ability and low-self concept.

One of the things we need to do in education is to communicate to pupils the successes they have achieved in their learning. We can communicate to children what they have achieved, not what they have not achieved. We have got to learn to help children see that they are learning and that they are a learner.

The school has to build into children two perceptions that are prerequisite to learning success. One is that we must build into children that school is a good place, where significant things happen. The other perception is "I can make my way in school."

It is simply not enough for us to say that children have to learn to handle failures, that they can't always enjoy success. This is true, but we don't have to provide failure for children. The only people who can handle failure are those who have a great backlog of success. A person with a backlog of failure never learns to handle it.

People have unique ways of learning. The research on creativity suggests that creative people have found a unique way of learning and exploit it.

Some of the intellectual characteristics or learning modes of creative people deserve description. One is that they have what is known as re-definition capacity. They will redefine a problem in terms that make sense to them. The less creative person will try to just take over a ready-made definition of the problem.

Another characteristic of the creative person is that he tends to think at right-angles to groups in which he functions. This person is creative because he is seeing meanings that are not immediately visible or apparent to the less creative. They are not always appreciated.

A third characteristic of creative people is they tend to think divergently as well as convergently. They tend to see off-beat ideas, nuances of meaning, and shades of differences.

From one point of view, a creative person is simply one who has found a unique way of learning and uses it to advantage. There is one danger with this.

There are times when people, who have hit upon a mode of learning, or a way of solving a problem, use it in situations that are not appropriate.

One thing we can do would be to learn how we can communicate to children two ideas. One of them is that there are different ways of learning. The other, that any mode of learning must be appropriate to a given situation.

Preoccupation with emotional upset is the enemy of learning. We all know children, and adults, too, who are "learning cripples" because they are so pre-occupied with their own emotional disturbances that they cannot learn.

One of the major findings of the research done by Sarason in this area shows that the level of test anxiety of children tends to increase with grade.

This is unfortunate because, as the grades go on, we tend to give more tests. Test-anxious people do not get over their test anxiousness by being given more tests.

While test anxiety increases with grade, teachers' sensitivity to the children's test anxiousness goes down with the grades. We can't blame teachers too much. As children grow older, they become more skilled in covering up their anxiety.

Another finding about test anxiety and learning is that they are negatively correlated. The higher a person's test anxiety, the lower is his intelligence test score. One easy way to interpret this is that less intelligent people are more anxious people.

That is exactly the wrong way to interpret it. It is better to say an anxious person takes his anxiety to the test. The anxiety gets in the way of his performance and he makes a low score.

This makes all test scores suspect, then, especially if we don't know how children handle tests. The youngster, who is in double trouble in school, is the bright, but anxious child because his brightness will show through in the non-test situation. The teacher will recognize this and so will the parents.

One's sex makes a difference in the manner in which learning occurs. The evidence is clear that there are four times as many boys who are poor readers or non-readers as girls.

There is equally clear evidence that we have two to three times as many boys who are under-achievers as girls. It is well known that more than 95 percent of the children who are in speech clinics for functional disorders are boys.

While these fact may seem irrelevant, they suggest there is a difference in the way boys and girls approach the learning task.

Findings from various experiments indicate that female subjects are much more dependent upon their visual environment than are males for the clues used in perception. Since people act on their perceptions, their behavior is influenced by the way they perceive.

Other experiments of this nature indicate that girls are more sensitive to human relations and have a greater range of feeling about their experience.

There is one area in which girls are apparently markedly superior in performance to boys. Girls excel in reading, spelling, language usage, and reading comprehension.

On the other side of the ledger, boys are somewhat better than girls in analytical thinking, mathematics, and science.

It is possible that most of these differences are due to the way we rear our children. Some of these differences are not even known to ourselves even though we practice them.

The reading material which children are presented indicates to them in subtle, but nevertheless important fashion, that they are to behave in certain ways. We must face the fact that some of the behaviors which we teach children may either impede or facilitate their learning.

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NEW TRENDS AND DEVELOPMENTS

THE discussion of new trends and developments in education which I am to present is not comprehensive or complete, but it is interesting and contains useful information about some of the things going on in education.

I will make some predictions about the future, and to some extent, this is a bit of crystal-ball gazing. However, these predictions are backed by some reasonably firm statistical evidence. The material is not related to Industrial Arts specifically, but to education generally.

Let me start by saying that, in my opinion, we are in a record-breaking period of change in education. I don't think education has ever changed as fast as it is changing in the 1960's.

Why? The race for supremacy to space kicked it off, but this is not responsible for all that is happening. One factor is the realization that education is a real key to economic growth, full employment, national security, and the general welfare.

Another factor is the rapidly improving standard of living of the typical American family. Despite the current attention to the pockets of poverty, the typical family pocketbook can supply more things the American citizen wants.

With this preliminary explanation, let's turn to what is going on in education and to some of the directions for the future. The first trend we have noted is a lengthening of the school day and school year.

Our studies have shown that a little over one-fourth of the school systems have a longer term than they had 10 years ago. I don't think there is any question but that we are headed toward a 10-month, 200-day term. This will probably be the standard term in another 20 years.

We have also noted a marked increase in the length of the school day, especially in high schools. About 30 per cent of the school districts have a longer day in high schools than they had 10 years ago. Many have added 30 minutes; a few a full hour.

This could mean we are headed toward an eight-hour day in the secondary schools, although I am not as certain of this as I am about the 200-day basic term.

Along with these trends is a general tightening of the school year and school day. We are no longer closing the schools with every two-inch snow. And, you may be interested to know that study halls are on the way out. Kids are just too busy for study halls. This is no great loss, in my opinion. They were always a waste of time for teachers and students.

Here's the second trend or development which we think has far-reaching implications for quality education. Our research is giving us some indication of the eventual shape and design of the all-year school.

It is definitely coming, but not in the form of a four-quarter system which business and industrial leaders have been recommending. There is no evidence at all that this plan is gaining momentum.

The all-year school is coming in the form of a greatly expanded and improved summer school. The summer session of public school systems is rapidly losing its character of a make-up school, limited to those who have failed a grade or subject.

The summer school is becoming a place where the talented can move ahead in a special field or expand their interests to many fields of knowledge and training. This school is also making it possible for those carrying heavy academic programs in the regular term to take some not-so-academic subjects which they simply want to take.

This trend makes a lot of sense to me because it is in line with our philosophy of developing each student to his full potential. It provides a substantial block of time that can be used to fill in the gaps and shortcomings of the regular term.

And since we already have an expensive plant and facilities available —why not use them? Our old idea of school from mid-September to June really grew out of an agricultural economy. I doubt whether 95 per cent of our children are needed any longer for spring planting, summer cultivating, and fall harvesting.

Enrollment and programs in the summer are growing rapidly. One-fourth of the 250 largest school systems are now employing for summer work at least 20 per cent of their regular high school staff members. A few in California are employing between 30 and 50 per cent of their high school teachers.

I think it is possible that within a decade or so the typical American high school will be providing a summer program for at least half of their students every year.

Another trend is the extension of the free school system. Following the leads of California and Florida, more and more communities are going to see the need for, and give financial support to, public junior colleges.

I think we can see the day ahead when most communities of any size will offer 14 instead of 12 years of free education.

Several factors will contribute to the movement. One is the growth of college enrollments. It will double between 1960 and 1970 causing lack of space. Another factor is that the best are closed to the average student. There is also the high cost of four years away from home. College at home can reduce the four-year cost by one-fourth to one-third.

More people are going to see that it may be cheaper and better to do it with public funds instead of private funds.

In some cities the daytime high school is becoming the night time college. High school hours are from nine to four, while college hours are from four to nine. At least it's a way to start.

The school program or curriculum itself is undergoing great change. Time permits only a few brief observations. First, accompanying the general beefing up of the high school curriculum is a gradual change in graduation requirements. The number of Carnegie units required for a high school diploma has been increased from 16 to 17 and 18 by many school systems.

Second, subject matter is being moved downward in the curriculum. An example is first year algebra, which for many years was taught in the 9th or 10th grade. In many schools the talented are getting this subject in the 7th grade and most of the regular college preparatory students in the 8th.

Third, in all probability the talented kids will get more and more attention in the years ahead. I think that before long the American public will take a long second look at the untalented.

Why? Let me explain. In 1950, we had approximately 8 million boys and girls in the 14-17 year age bracket. By 1970, we'll have almost 16 million in this group. In 1950 there were about 8 million in the 18-21 year bracket. By 1975, there will be twice as many.

The dropout rate is now about one-third and the situation is improving gradually but slowly. Let's suppose we make real progress and cut this rate to one-fourth by 1970. What I want you to see is that one-third of 8 million is two and two-thirds million, while one-fourth of 16 million is 4 million.

If you think we have problems with juvenile delinquency now, just wait a few years. I want to say, "we haven't seen anything yet!" We are facing a chaotic situation.

What I don't understand is why we don't devise a program of education for dealing with this group. It will be expensive, but far less costly than institutional care.

Along with these many changes, education itself is becoming a bigger and bigger enterprise. This year the enrollment of public elementary and secondary schools is almost 42 million or 22.3 per cent of the total population of the United States.

The annual cost is now approximately $21 billion per year. But this doesn't look quite as big when we consider the fact that this is the bill for the daily care of 22.3 per cent of the total population.

Let's rule out the possibility that we might teach them something and just talk about child care. Do you know that this annual bill for education amounts to about 50 cents per hour per pupil? This is about the same as the going rate for a 14-year-old baby sitter.

What is the public getting for the 50 cents per hour it spends on public education? It gets a safe and reasonably comfortable building, all the furniture, all the utilities, a low-cost lunch, two-way transportation, and a fairly good grade of entertainment with spectaculars on weekends.

Can we afford more for education? Of course we can. If there is any doubt in your mind, think of the number of two-car families, the number to whom a new car every two years is a necessity, and the number who even own two homes.

Dr. William G. Carr, executive secretary of the NEA, has an illustration of our ability to support education which made a great impression on me. Dr. Carr explains that other countries in the world have considered themselves extremely fortunate when they could provide their people with the basic necessities of food, clothing, and shelter. Most have felt well off when they could keep large numbers of persons from starving through the winters.

Think of this in connection with the low caloric food industry in the U. S. This country is the only country in history that could afford to spend millions of dollars each year on foods guaranteed to provide little or no nourishment.

I want to mention a few new and dramatic things going on within our professional organizations. At the Detroit convention of the NEA in 1963, the delegates from the 50 states and thousands of local associations brought forth two dramatic new ideas for effective professional action.

The first was the concept of professional negotiations, a plan for settling, in an orderly and peaceful way, disputes and deadlocks over salaries and other problems.

This new procedure means that when school boards and teachers come to a complete deadlock on a salary problem, the problem would be passed on to a third local group to study and recommend a settlement. Such a third group typically would consist of two representatives appointed by the board, two appointed by the teacher's association, and one mutually agreed to by both parties.

If this body fails to affect a settlement, the entire problem would be passed on to a similar state group consisting of two persons appointed by the state education association, two by the state board of education, and one both groups can agree upon.

Of course the whole idea is flexible and could work in a variety of ways. The important thing is that it offers a means of solving some seemingly impossible problems in the years ahead.

The plan would be stated in advance in some type of written agreement signed by the board of education and the local teacher's association. You may be interested in knowing that many such agreements have already been signed.

The NEA has a booklet on this topic which is available to local education associations.

The second new and dramatic idea was a plan for applying sanctions to a district which fails to measure up to the lowest mimimum educational, professional, and ethical standards. Sanctions would be used sparingly, and only in the most serious cases.

In a program of application, the NEA and a state association would ask members not to accept employment in the district until the conditions were corrected.

These associations would also ask colleges and universities, and teacher placement agencies not to recommend teachers to the district. The process of sanctions, in effect, would close off the supply of teachers to the school system. And, it works.

Another new idea which is now working with great success is a plan of state associations and the NEA making available to local associations the services of highly skilled salary consultants.

The NEA now has three excellent men who have visited and worked with hundreds of local salary committees. In almost every case there has been subsequent improvements in the salary schedule. This is actually a double achievement because they are called in only in the most difficult situations.

These men come to your community and spend several days working with your leaders and committees. They will help prepare a new salary scale and assist in mapping out the strategy needed to get it adopted.

The NEA also has another consultant on insurance and various other fringe benefits. He is also available to help you in developing effective plans for work in this area.

In addition to expert help of this type, the NEA and the state associations are offering more and more direct services to teachers.

The new NEA Term Life Insurance plan is, in my estimation, the best thing of this type available anywhere. In February this plan was two and a half years old. We already had $350 million worth of insurance in force. The plan was so successful that at the end of the first year we were able to add 48 months of disability pay and to provide double indemnity coverage to certain policy holders at no extra cost.

A man under 30 years of age can get $10,000 worth of life insurance which pays $20,000 in case of accidental death, plus 48 months of disability pay at $100 a month. This costs $9.10 twice a year.

The next thing coming up is a mutual investment fund for teachers. This will probably be in operation next year. The NEA Mutual Fund will operate like any other investment fund except that it will be on a nonprofit basis.

The members will be permitted to invest their savings or a specified amount each month. The money is pooled and invested under expert management. Investments would include real estate, tax exempt bonds, common stock, and other securities paying a reasonable dividend and subject to capital growth.

Of course only time will tell whether the Mutual Fund will be a success, but most of the persons working on this program feel that the typical cost of overhead and administration can be reduced from about 8 per cent to perhaps 2 or 3 per cent.

This alone should make the plan attractive to many teachers who want to set up some type of long-range investment program.

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Where Do You Put The I?

BY way of introduction, I am a Methodist Minister and I'm proud to be, and, of course, if I were not proud to be a Methodist Minister, I'd be something else. But if all of you were Methodists, I'd say something was wrong with your organization. I can tell you that my distinguished father, who in four weeks will be ninety years of age, is a Presbyterian Minister and has been longer than I've been around, and my late brother was, for many years, a Minister of Music of the First Baptist Church in Wilmington, North Carolina, and we say at home that makes Mother a United Brethren.

Now, we'll get along with the sermon and I feel more at home. Don't you see I do? I like to read the newspaper as do most of you. I read the comics, I read the sports section, I read the society editor's page. I always like to know in my community who is being married, who is engaged. Some years ago, I picked up the Sunday paper and to my horror, under the picture of a beautiful bride (and I still have the picture in my files), I saw this caption, "Miss Jones *untied* in marriage to Mr. Brown." Now, I cut it out and when I saw the society editor sometime later, I said, "Look here, what are you trying to do having Sister Jones being *untied* in marriage to Mr. Brown?" She said, "Mr. Emurian, you know what it meant." And I said, "Yes, and so do you. You had proofread that line so often that your eyes fooled you." The linotype operator had had a rugged night and he made a mistake and I understood it, but I cut it out and put it in my pocket and now I know the difference between being *united* and being *untied*—it's where you put the *I*. If you put the *I* before the *T* you are *united*, if you put it after the *T*—you are *untied*. In our whole life, we are *united* or *untied*, depending on where do you put the *I?*

There's a man in my church and I said, "Carl, we're going to do some work at the church next Saturday and we need some hefty young men. Come on up and help." He said, "Preacher, I'd love to help you, but I can't." I said, "Why not?" He said, "Saturday, in my home, is Honey Do Day." I said, "It's what?" He said, "It's Honey Do Day." I said, "Pray, tell me what is Honey Do Day?" He said, "All I hear is 'Honey do this and honey do that.' " In our homelife we are *united* or *untied,* depending on where do we put the I.

There was a man who married a girl who was very homely. He knew it, but he loved her. But wherever he went, he took her with him and someone said, "Joe, you know your wife is so homely. Why do you always take her with you wherever you go?" He said, "I'd rather take her with me than kiss her goodbye." In your home life you are *united* or *untied,* depending on where do you put the I?

There was a Quaker preacher who married a couple and at the end of the ceremony, with the typical dignity that befits a Quaker preacher, he shook hands with the young man and said, "Young man, thou art at the end of all thy troubles." And ten years later, after a red-hot family fight the fellow recalled those words. He said, "That two-tongued, lying, hypocritical preacher! When I get a hold of him, he's going to apologize. I'm going to make him swallow his words. In fact, I'm so mad, I'm going to see the old boy right now." So he got in his car, drove two hundred miles and arrived at the crack of dawn. He yelled at the preacher's house and the preacher came in his nightgown to the window and said, "What is it, my child?" And the man told him, "Ten years ago when you married us, you said, 'Thou art at the end of all thy troubles,' but you listen to me you lying hypocrite" and for two hours the fellow told what had happened and then said, "Now do you want to apologize?" The preacher said, "I have no intention of apologizing, son. It is true I told thee that thou art at the end of all thy troubles, I did not tell thee at which end." Now, in your home life you are *married* or *marred, united* or *untied,* depending on where do you put the *I?*

Do you put the *I* in the middle of *bliss?* The security of the home is the security of the man who loves the woman and the woman who loves the man and the children who have sense enough to realize it without your telling them. There are some people who put the *I* in the middle of *antique*—ANT*I*QUE and God save you if your wife worships furniture. I've had some people in my church who worship furniture. Now, the husband pays the bills, but the faithful man has to come in the back door because the spouse had the living room so spotless, she didn't want it to get dirty with the man who earns the money so she can keep it spotless. She has a housecleaning maid and they worked a whole week shining floors, cleaning rugs, and chairs upon whose upholstery the shadow of James Madison fell as he was running from one state to another.

Now there are people like that. I hope you don't live in a house like that. People are more important than things. People can make chairs, but chairs can't make people. I figured that out long time ago. Not that you should mutilate furniture, but don't be a slave to it and don't call it the living room if you don't live in it. The only time you go in the living room is when someone dies and you view the body in the living room—then it's called the dying room.

There are some people who put the *I* in the middle of *suspicion.* That's SUSP*I*C*I*ON and there's no hell on earth like suspicion.

There was a man whose wife was suspicious of him and he thought to himself, "Well, I'll fix her." He went out one night and came back and he had a blonde friend from whom he got some hair and put it on his coat. His wife said, "Ah, hah! You are playing around with a blonde!" And the next night, he got a brunette's hair on his coat and his wife said, "Ah, hah! You *are* running around, you Casanova you!" The next night, it was a redhead. "Ah, hah! said his wife, "You Lothario—you think I don't know!" And so the next night, he brushed himself off clean and came home. She said, "Ah, hah! Now you're playing around with a baldheaded woman!"

In your home life, it is *united* or *untied,* depending on where you put the *I*! There is no *I* in *joy.* There is no *I* in *sorrow.* There is an *I* in *happiness.* There is an *I* in *grief.* "It takes *two* for a *kiss. One* for a *sigh.* Two by two we marry; one by one we die. Joy is a partnership. Grief weeps alone. Many guests had Cana; Gethsemane but one."

The same basic experiences of life come to us all. They will happen to me and they have happened to my parents before me and they will happen to you. The same basic experiences of life are common to us all. It depends on where do we put the *I?* Do we put it in *happiness* or *grief?*

There is no *I* in *work.*
There is no *I* in *play.*
There is no *I* in *learn.*
There is no *I* in *school.*
There is an *I* at the beginning of *intelligence.*

There is an *I* at the beginning of *ignorance* and where two people are exposed to the same opportunities and one will learn and one will not learn, it isn't because of the same opportunity but *where* do you put the *I?*

A little girl came home from school. She seemed worried and scared to death. Her mother asked, "What's the matter, honey?" "Oh, I've failed to pass, I've failed!" Her mother asked, "How many questions did you fail?" "Mother, she only asked one and I failed." The mother said, "Pray tell, what was the question she asked?" The little girl said, "She asked, 'What do you call the thing a hen lays an egg on?' " "Well," the mother said, "Honey, you know the answer, don't you? What did you put?" She said, "I put an *average.*' The mother said, "An average? Where did you get a stupid answer like that?" The little girl replied, "Right out of the textbook—the book says 'the hen on an average lays 200 eggs a year.' "

These three men went to an AIAA Convention at the Mayflower Hotel and they came down to get breakfast. The waiter asked, "What will you have?" The first man said, "I'll have orange juice, buttered toast, sausage, and coffee—and a scrambled egg." The waiter said, "All right" and turned to the second man who said, "I'll have the same thing only poach the egg." The waiter said, "Fine" and turned to the third man who said, "The same thing only eliminate the egg." The waiter said, "Excuse me, what is it you wanted?" And the man said, "I said the same thing but just eliminate the egg." The waiter went to the kitchen and came back and said, "Sir, I'm very sorry the eliminator has broken down, can I scramble your egg like the first man here?" There's an *I* in *intelligence* and there's an *I* in *ignorance* and it isn't the opportunity that's presented, it's *where* you put the *I?*

Those of you who have travelled extensively know how interesting it is when you go to the eastern countries—Japan, China, Korea. How they learn and how they study! They write up and down and the student looks at the pages and thinks it's wonderful! He reads down and thinks, "My what wonderful ideas." He then goes up to the top of the page and his very head nods "Yes" to the truths he learns—but, oh brother, come back to the good old USA—we start from the left and read to the right. We stop and think—"Oh no, we don't believe that—no sir—no, we don't believe that at all." In the very act of teaching, we do what we're being taught. We shake our heads at the truth we're learning. When I was a boy and you said, "Contact," that meant a fellow was grabbing a propeller of a plane and pulling it and dropping back—hoping he wouldn't lose his head. Now, they talk about *contact lenses.* The other day, the police stopped a fellow in Arlington and asked, "Where's your driver's permit?" After looking at it, the policeman said, "According to this, you should be wearing glasses." The man said, "I have contacts." "I don't care how many contacts you have—I'm taking you in."

A little girl came home bawling. And her mother asked, "Honey, what's the matter with you?" The little girl replied, "I've failed, I've failed." The mother looked at the report card and said, "Honey, you have straight A's." "But look at the bottom of the paper," responded the little girl. "There's the word sex and after it there's an 'F' and I don't even remember taking the class!"

There's an *I* in *industry* and there are several *I's* in *initiative* but there's an *I* in the middle of *laziness* and two of you can have the same opportunity presented and one of you will industriously do something about it while the other will lazily sit down and do nothing but complain and the secret of it isn't the opportunity but WHERE DO YOU PUT THE I?

There's an *I* in *music.* There's an *I* in *discord* which is fair enough. The Lord only gave us seven notes and if we take the notes and all their variations, some create music and some create discord.

There is an *I* in the middle of *faith.*

And there's an *I* in skepticism and the same experience can happen to two people and one will go to church the following Sunday and cry, "Lord, I believe, help thou mine belief" and the other will never darken the door of a church again. It isn't what happens to you, it is where do you put the *I?*

Whenever a national catastrophe occurs, a tremendous loss in a plane, a ship going down, many people lost in a train accident, an earthquake in Alaska, I wonder how many of them will never talk to God again and how many will talk to him because to whom else can they go?

I remember a scene in a movie of an Eric von Remarque novel when a soldier said to the old professor, looking at the ruins of a great German city, "Why did God do this to us?" The professor said, "You are asking the wrong question. You should have asked, 'Why have we done this to God?' "

There is no *I* in *money.*

There is no I in *cold cash* but there is an *I* in *liberality* and there is an *I* right in the middle of *stinginess* and two people will earn the same salary and one will give to every worthy cause and the other won't give to anything. Some folks seem to be born in the objective case and automatically say to everything, "No."

There was a Methodist preacher who went to a conference (and brother was he stingy!) in Kansas City. He was the type who held onto a nickel and a penny so long that Lincoln was riding on top of the buffalo. He found himself out in Kansas City and he got sick and he was too stingy to call a doctor until it dawned on him if he died it would cost a lot more to ship his body home. So he looked in the yellow pages of the phone book under "Physicians" and he found a name that sounded sympathetic so he called. "Is the doctor in?" "Yes." Second question, "What does the doctor charge?" She said, "$5.00 for the first visit and $3.00 for every subsequent visit." He said, "I'll be right over." He went right over and she showed him in. He said, "Doctor, here I am *again*." The doctor examined him and said, "Keep on taking the same medicine I gave you the first time."

There is an *I* in the middle of *liberality*.

There is an *I* in the middle of *stinginess*.

Somebody told me about a bird that had a nest with a hole in the bottom. One bird asked the other, "Why do you have a nest with a hole in the bottom?" The bird said, "I want to be creative but I hate the responsibility."

There's no *I* in *beauty*.

There's no *I* in *pretty* and there is an *I* in the middle of loveliness and while the Greeks worshipped the holiness of beauty, the Jews reminded us of the beauty of holiness. And while the Greeks carved their ideal out of marble, the Jews produced the perfect man in Absalom, the handsome son of King David who ended up hanging by his own golden hair from the branch of a tree.

"Let me grow lovely growing old.

"So many fine things do, laces, ivory, gold, silks need not be new and there is healing in old trees. Old streets a glamour bold. Why may not I as well as thee, grow lovely growing old." We all can't be prettier than others but the loveliness of God can shine through us and it is a thing that is not limited to physiognomy of a man's face or the biology of a woman's body.

The church that I serve presented twice this year the living dramatization of Leonardo da Vinci's "The Last Supper." We recreate with living characters this drama. It has become widely known since it was first produced in Portsmouth, Va., ten years ago. Each of the Apostles, in the soliloquy that I wrote for him to speak, addresses himself to the Lord and captures the moment that Leonardo da Vinci wanted to capture—the moment just after the Lord said, one of you will betray me?" And each man said, "Lord, is it I? Is it I?"

Now, if there is an *I* in the middle of *sin*, we could bemoan our fate but God remembered and did not leave us comfortless but in His love revealed himself to us.

There are two *I's* in *religion* and I am glad there are. REL*I*G*I*ON because the first *I* tells me that I am loved. The greatest fact in all history is that God loves me and I don't deserve it, neither do you. Even when we are dressed up and look at our best, God knows us inside. He knows the war in my soul between the flesh and the spirit. He knows the troubles in my heart. He made me that way. I am made in His likeness. But He loves me. That love cures my physical ills—it cures my mental ills, it cures my spiritual ills. People languish in our mental institutions today because they are brought up in an automated society where nothing can love them because who under God wants to love a machine? Nothing! And things cannot suffice us who are not made as things. We are more than things and things will never satisfy us.

The other *I* means, therefore, I must love in turn. It is amazing, isn't it, the great revolutions that have occurred? Copernicus came along and we had a revolution in our ideas that affect the universe and Darwin came along and we had a revolution in the whole idea of man's heritage and then Karl Marx came along and there was a economic revolution and Freud came along and there was a psychiatric revolution. But you know the greatest truth in all the world before and after these revolutions. It is that God is love. Before and after Karl Marx, God is love. Before and after Charles Darwin, God is love. Before and after frustrated Sigmund Freud, God is love. And the greatest fact isn't who will send first into outer space because all the monsters that come out of outer space are the projections of our own fears. The great fact is that the Creator came from outer space to tell us two things: Don't be afraid—I love you. So there are two *I's* in religion. I am loved by God, therefore, I love in turn. If this were a sermon I would start out with a text: Psalm 84, Verse 11—here are the words:

"Unite my heart to fear thy name."

In every relationship of life, you and I are united or untied depending upon the answer to this question: where do you put the *I*? AMEN.

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THE PEACE CORPS AND INDUSTRIAL ARTS

MY topic is industrial arts education and the Peace Corps. I am not an industrial arts teacher or administrator, let alone a specialist in industrial arts education. I do, however, hopefully know something about the Peace Corps and especially about its activities abroad.

I served for a time as the Peace Corps representative in Malaya. Moreover, almost anyone who works for the Peace Corps has some knowledge of the subject of education inasmuch as Peace Corps volunteers are primarily engaged in teaching. I do not know how well it is understood among the American people, but the fact is that some 65 percent of Peace Corps volunteers abroad are teaching at the primary, secondary or university levels. I am, therefore, going to talk first about education in the Peace Corps in order to set a proper context for such remarks as I have about industrial arts education and the Peace Corps.

The Peace Corps today has projects in some 45 countries. I believe it is not giving away secrets to say that in all probability some three or four additional countries will be added to our Peace Corps program within the next few weeks or months. Most of these countries—some 18 in Latin America, 15 in Africa, 8 in the Near East and South Asia and 5 in the Far East—were recently under European rule or have societies, political systems and economies which are basically colonial in nature.

It was not the intention of the colonial powers to provide their subject peoples with comprehensive educations. The colonial educational systems aimed primarily at providing some training to those few people who were needed for certain kinds of jobs or services.

This meant for the most part clerks, policemen, drivers, and some lawyers. Professional people and skilled labor was not in great demand. Most of the economies of these formerly colonial countries were agricultural or otherwise chiefly concerned with primary production. Rather than skilled workers, the economies needed people with low skills, but a high degree of docility. In many countries of Asia and Africa, such skilled labor as was needed, chiefly in the building trades, was supplied by immigrant workers. The Chinese in particular fulfilled the need for skilled labor in much of East Asia.

You and I, raised in a very different system, one which believes that each person requires an education to be an intelligent citizen, which eschews the concept of an elite, and which believes that the educational system should offer students a variety of professional and occupational choices, would find it easy to criticize these colonial educational institutions.

The ironic aspect is, of course, that in Great Britain and other European countries, education is in varying degrees being overhauled. Increasingly, the British are studying American educational concepts and revising their educational programs to create a better educated, more highly skilled citizenry. In many former British colonies, however, native administrators are defending and holding to the systems of which they are, in fact, products. Here is certainly a good example of cultural or technological lag. The fact is, however, that they are waging a losing battle.

Today throughout most of the regions where the Peace Corps is working, education is the number one domestic issue. We seldom hear much about this issue here in the West. Our newspapers are instead filled with the problems of the cold war, communism and how to combat it. If it is not politics, it is economic questions in the underdeveloped countries which receive attention in our papers and journals. The truth is that often the local peoples are little concerned about such matters, and focus on the problems which they see immediately at hand. For many, the most pressing problem is how to obtain an education for their children.

One might say that in a society that is really backward, one which has not begun the upward ascent, there is probably little or at least only marginal interest in education. Farmers are chiefly interested in having their sons available to help with the crops or to help take care of them in their old age. But in societies where the vision of a better world has been glimpsed, where the trend of "rising expectations" has begun, where there is a ferment of social and economic change—education is regarded by most as the means to higher income and status, and a better life.

Leaders are perplexed for the answers to numerous tough questions. How many people should be educated? How should they be educated? What kinds of curricula hould be devised? How are teachers to be trained and in what subjects? How are the new schools and new teachers to be paid? At what pace should this development be undertaken?

It is beyond my purpose here this evening to try to deal with these questions, and in any event I am doubtful that I could give you anything like a comprehensive and accurate picture of the answers as they are being found on a world-wide basis. It must be enough for me to say that the task is to transform the colonial educational institutions into national, socially useful and productive, comprehensive educational systems.

The need for careful planning, coordination of efforts, the careful use and husbanding of resources is apparent. It would be an extremely difficult job even if funds were ample and clear-sighted leadership were available. Too frequently they are not.

I should like to devote the remainder of my remarks to one aspect of the educational revolution now in progress in Asia, Africa and parts of Latin America. That is the growing emphasis upon education in vocational subjects. While it is difficult to generalize, it is probably fairly correct to say that educational leaders in most countries are uncertain as to how instruction in these practical skills should be provided.

Should such training be included in the 5 or 6 years of primary education which they hope to give to all their young people? Or should training in vocational skills be given primarily in the high school, and if so, should there be separate high schools to teach such subjects?

In most countries, there has been for many years at least a small post-secondary school which aimed at providing the handful of technicians necessary to keep the modest communications and transportation systems of the country operating. How should instruction in industrial arts be geared into these institutions? There is further the question in most countries of whether or not instruction in such subjects can be appropriately introduced at the university level.

Another set of questions has to do with students. How are students to be selected for training in vocational skills? Are there examinations which would give some indication of those who have greater talents in this direction rather than, say, in the arts or humanities? Vocational training is comparatively much more expensive than instruction in the arts and humanities. At least in the beginning, most countries cannot contemplate providing such education on a large scale. It is particularly important therefore that they should obtain those students who are likely to get the most out of such an opportunity.

The present state of vocational and industrial arts education in most countries of Asia, Africa and Latin America is, to say the least, confused.

There is lack of direction, absence of a basic philosophy or a set of conceptual tools, lack of an institutional framework, and inadequacy of funds, and a desperate shortage of teachers. It is really more than a shortage. In many countries, teachers are virtually non-existent.

Most countries are, of course, receiving some assistance. A number of international agencies are trying to provide some help. The United Nations, the Colombo Plan, the International Labor Organization, the AID program of the United States, and the Peace Corps; all are in the field. But in spite of this help, the fact is that almost all of these countries are in the pioneer stage of development as far as vocational and industrial arts education is concerned.

I should like to focus on one particular aspect of the problem, namely the difficulty of finding a sufficient number of well-trained and experienced teachers. Most countries are finding it possible to find some funds to equip at least a few schools with the workshops with which to give instruction.

Conceptional tools may be weak, direction may be poor, confusion may exist and duplicated and wasted efforts occur. But the most difficult problem of all is the inadequacy of the supply of teachers. It is extremely difficult for most countries to find teachers who can give even elementary instruction in vocational subjects. People cannot be attracted for the most part from local industry. For one thing, local industry is small, fledgling and struggling and has really no one to spare. If the economy is expanding at all, anyone who has a skill can go to local industry at much better pay than he can earn as a teacher.

Another problem is the difficulty of finding good jobs in industry for those who are properly trained. This statement, I am sure, seems at variance with my earlier remarks about the great need for trained people. While the need is there in virtually every country where the economy has begun to expand, the fact is also that in some countries certain groups of people who have traditionally been engaged in a particular vocation or trade are most reluctant to admit to their work someone who is not from their own group.

I have in mind particularly the Chinese who were imported in large numbers by the colonial powers in the Far East to engage in skilled vocations. The local or indigenous people find that even if they do possess a skill, such as a carpenter, a lathe operator, or an electrician, frequently they are not able to land good jobs in private enterprise simply because guild organizations, more powerful than some of our trade unions, monopolize jobs.

It might be useful and interesting for you if I were to give you an example to illustrate some of my remarks.

Malaya, or more correctly I should now say Malaysia, is an Asian tropical country which has obtained its independence from Great Britain in 1957. It is a little unusual as an under-developed country in the sense that it obtained its independence peacefully and thus remains on good terms with the former ruling power, and it has substantial assets in the way of transportation and communication facilities as well as hospitals and a good civil service.

Malaysia has a very lopsided economy. It depends primarily upon prices obtained for tin and rubber marketed in industrialized countries. It is rich by Asian standards. Moreover, Malaya has a high degree of literacy. It is perhaps the third or fourth most literate country in Asia, and has rather substantial, by comparison, entrepreneurial and managerial resources. Industry accounts for only 10 to 15 percent of the national gross product, but nevertheless, this makes Malaysia the 3rd or 4th most industrialized country in Asia.

As in other former British colonies, education in Malaysia is based upon the British colonial model. This means that only a handful of young people are permitted to enter secondary education, that the great emphasis has been and still remains on arts and humanities.

But within recent years, especially within the last three years, the Malaysians have come to appreciate that they must develop a better and more comprehensive educational program if they are to have an adequate number of managers, technicians, administrators, entrepreneurs, teachers and so forth.

Educational leaders, almost all of whom are now Malaysians rather than expatriate British, have given much thought to the problem. These men, it is safe to say, are among the hardest working and most dedicated men in the Malaysian Government, but also the most perplexed.

At the moment the vocational education picture in Malaysia is very confusing. Most high schools, of which there are some 70 or so in the country, have one or two rooms set aside as a kind of workshop for boys. A fewer number of high schools have something modest in the way of instruction facilities for girls.

In addition, the Malaysian Government is embarked upon a program of establishing vocational high schools. At present, there are only 3 such schools in the country. Experience with them is too short to know whether they are successful, or more particularly to know, what sort of modifications must be introduced to make them more effective.

There is, in addition, a program in which I have a great deal of interest which aims to create a number of rural vocational schools. These will cater primarily to farm youth who have completed 6 years of primary education but who are not able to pass the secondary school entrance examinations, or, in a few cases, are financially unable to go on to secondary school.

Ten of these schools are now in operation and approximately two dozen are planned. The maximum enrollment in each school is contemplated to be around 300 with a teaching staff of 12 to 15. They are not coeducational and most of them are planned for boys.

The curriculum in the boys' schools emphasizes such subjects as carpentry, brick making, sheet metal work, mathematics, poultry raising, vegetable gardening, auto mechanics and similar subjects. The age-range of the students in these schools is between 12 and 16 years and curriculum is 3 years in length. These are residential schools although many boys and girls actually live at home as the schools are located in fairly populous rural districts.

I have visited some of these schools and must say that I am impressed. They are well laid out, well constructed and very well equipped. The Malaysian Government has provided the funds for construction, has designed the actual layout of the schools and has seen to the actual building of them.

The equipment has been provided by the Canadian Government under the Colombo Plan and a visitor will find some of the most up-to-date machinery and equipment found anywhere. I should say also that the schools are generally well administered, the head masters are experienced in administration and are adequately supported with secretarial help, office equipment and supplies.

I should say the problems are essentially two. First, there is conceptual confusion as to what the purposes of these schools are. On the one hand, educational officials will tell you that the aim is to turn out a person sufficiently skilled to get a job in industry as carpenters, bricklayers, or mechanics. But it is also argued that the goal is to train young men who come out of the villages so that they will have a more productive and useful life when they return to the villages.

A second problem has to do with the teachers. The Malaysian Government has found it virtually impossible to recruit skilled artisans to become teachers in these schools. At the present time, instructors are obtained by recruiting teachers of English, history, geography or math from the primary and secondary schools and retraining them for service in these rural vocational schools.

The average teacher in these rural schools have 6 years of primary education, 3 years of lower secondary and 2 years of normal school plus 2 or 3 years of actual teaching experience, all in the social sciences. To equip him for his assignment, the Malaysian government takes such people and provides them with 9 months of vocational training.

During these 9 months, the teacher is given approximately 4 to 6 weeks in each of the subjects taught in the rural vocational school. These are 4 weeks of auto mechanics, 4 weeks of carpentry, 4 weeks of bricklaying, 4 weeks of math, and so forth. The Malaysian government does not yet have any adequate vocational training facilities and these teachers are retrained on a more or less ad hoc basis.

In discussing these circumstances, the headmasters of these schools are quite frank to say that their situation is very bad. It is truly one in which the blind are leading the blind. The teachers know they are inadequate to the task and hence have little confidence in themselves, the students perceive that their teachers are lacking, and parents who in the early stages had some interest and even enthusiasm for the schools now tend to regard their sons and daughters as having wasted 3 years. It is a sad and pathetic situation.

I might add that the Malaysians are rather well along in their planning to build a 3-year, residential college which would train vocational teachers exclusively. This college has had the benefit of Canadian experts, some 7 or 8 of them in fact, who have planned the school in all of its aspects. Conservatively estimated, however, it will be approximately 4 years before this college will produce its first class. To the best of my knowledge, there is no scheme for training vocational or industrial arts teachers abroad.

In preparation for my talk, I tried to find out just how many Peace Corps volunteers are engaged in vocational or industrial arts education around the world, and in how many countries. I was not very successful because of a certain amount of confusion as to how vocational and industrial arts education is defined. But I would estimate that we have perhaps no more than 100 persons actually working as full-time teachers in vocational subjects, in a dozen countries. Almost all of these people are teaching at the secondary level and only 3 or 4 in teacher training institutions.

In closing, I should like to pose the question how does all I have said relate to the field of industrial arts education? I am not able to answer the question for you. I am not an industrial arts educator. What I have tried to do is to give you some idea of the current condition of education generally in the former colonial countries of Asia and Africa. I hope that what I have said is meaningful enough to enable you to see ways in which industrial arts education may be applicable.

I might suggest, however, that strictly professionally speaking, it may be that industrial arts education is too advanced or too sophisticated for the immediate needs of the countries in which the Peace Corps is working.

The educational officials and leaders of most of these countries are only beginning to appreciate the need for vocational or industrial arts type instruction. And where this need is realized and where action is being taken, the emphasis is on vocational education, on developing skilled manpower. These countries are, as yet, too poorly developed, in virtually all respects, to begin to differentiate between levels of instruction or to discuss in any meaningful way concepts of instruction.

But I would also argue, and with a much stronger voice, that these countries need the advice and help of industrial arts education specialists, at this moment perhaps more than at any other time. Certainly help is needed in devising a philosophy, in creating sets of agreed-upon conceptual tools, and in trying to bring about a certain amount of unity in development. Moreover, if specialists in industrial arts education can somehow provide the fledgling leaders of industrial arts education in these countries with the means to inculcate industrial arts education more rapidly, to speed up the processes of education if you like, would be most useful.

I would thus close on the positive note of urging you to action. Whether it is through steering your institution toward some international relationship or through urging your students to join the Peace Corps or through you personally involving yourself in an overseas program.

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DIRECTIONS IN POST-BACCALAUREATE TEACHER EDUCATION PROGRAMS

I don't especially care for this search for trends, for two reasons. The first reason is that it is usually possible to find a trend in any direction that suits your biases or predispositions. If I look in the right directions I can find a trend for Senator Goldwater or a trend for President Johnson.

In graduate education there is a discernible trend towards requiring graduate work in the subject to be taught and a trend to straight professional work. There is a trend towards requiring research and a trend away from requiring research.

One trend is in the direction of more apprenticeship. Another is for more graduate exposure to the humanities. One trend is towards generalization, another towards increased specialization. All of which adds up for me to a trend towards more diversification, more individuality in programs, and this is good.

The other reason I am opposed to seeking trends is the danger of what is likely to happen if you find a legitimate one—and sometimes you do. The danger is that if you popularize the trend, you begin a bandwagon, effect an educational fad, and this operates against thinking.

We should pay a great deal of attention to our own experience, and not be too easily snowed by someone else's advice and suggestions—including mine.

The graduate of a master's degree program should be above everything a thinking person. It isn't necessary to remind us how rare a thinking person is. In fact, thinking persons are frequently unappreciated because they are unpredictable.

I won't attempt to digest for you all the trends in the fifth-year teacher education program. If you are interested in a summary of trends, I can refer you to a series of reports issued by the U. S. Office under the general heading of *Teacher Education Series* written by Henry Harap, specialist for teacher education. One of these bulletins, issued in July, 1962, is titled *Fifth Year Programs of Classroom Teacher Education: A Digest of the Survey Report.*

Obviously one of the issues is the proper division of the program into its three apparently inescapable parts. I'd like to see someone challenge the assumption that every graduate program must include these three parts.

I don't see how anyone can confidently suggest general formulae for the proper allocation of time between general education, subject content, and professional education, at the graduate level or any other level. It depends upon whom you are educating, for what, under what circumstances.

The most conspicuous trend in post-baccalaureate teacher education programs is diversity, which to some people means chaos.

Perhaps the best summary I can offer you is a capsule statement of the findings of two national commissions.

Twice within the span of the decade following World War II, Presidential commissions have taken stock of graduate needs of colleges and universities in the U. S.

In 1946 President Truman appointed a group of 30 distinguished educational and civic leaders and charged them with an "examination of the functions of higher education in our democracy and of the means by which they can best be preserved."

This commission's report on the graduate school emphasized graduate education's responsibilities other than the preparation of research specialists. It pointed out the increasing need for trained scholarly personnel in many areas of the nation's economic life. It cited the fact that most holders of the Ph.D. degree either become teachers of undergraduate students or enter nonacademic occupations.

The commission charged that the most serious inadequacy of the graduate school was in the preparation of college teachers, and stated that "single-minded emphasis on the mold of narrow specialism does not produce college teachers of the kind we need."

Recommendations were that graduate schools devise new patterns of organization and programs of instruction which will accomplish three tasks. These tasks were to maintain basic research and the training of research personnel, to train needed experts for nonacademic fields, and to train teachers adequately for all levels of higher education.

Some people feel that there is little present evidence that the recommendations of the Truman Commission have had practical effect, although there is continued ferment over the issues raised.

In 1954 the Fund for the Advancement of Education assembled a group of distinguished faculty members and administrators to discuss certain of the experiments it had sponsored in colleges and universities.

This group identified the critical problems confronting graduate education. It said that graduate schools are not providing effective training for college and high school teachers. Training in research is not producing men and women capable of providing the moral, intellectual, and political leadership needed.

It warned that the college populations of the future threaten to inundate the scholarly traditions of the graduate school. Graduate schools must produce more people who are "neither mere scholars nor unscholarly teachers, but scholar-teachers."

This committee pleaded for cooperation among colleges and universities in the development of stronger programs of teacher-education and education for other professions. It rejected the notion that present emphasis upon research and advancement of knowledge is inimical to good teacher education. It opposed the development of doctorate degrees other than the Ph.D. degree.

The committee restated a conviction that thorough knowledge of subject matter is the basic prerequisite of the teacher. It said that enthusiasm and fervent interest necessary for good teaching stems from close personal association between scholar and student. It praised the intellectual growth which comes from "uncompromising wrestling with subject matter." It said that good teachers who have been produced in this way are not rare.

The group noted that graduate schools have not given the attention to the teaching-internship aspects of the preparation of future college teachers which the importance of this aspect of the graduate program deserves.

There is a danger in all fields of becoming degree-happy and of becoming research-happy. Traditionally the graduate program was at least partly for research. What research is pertinent for industrial arts?

Some graduate programs in industrial arts should undoubtedly concentrate on the primary task, which is preparation for effective teaching, without attempting to make a researcher of the student. I know this is done in many programs.

Here are the ten stated graduate degree aims in Indiana, ranked in the order they were placed by an 18-man jury of heads of industrial arts departments. They are (1) draw practical implications from research, (2) acquaint student with problems, (3) develop a professional person, (4) acquaint with research techniques, so he can use educational studies, (5) continued study of fundamental problems of teaching profession, (6) extend, reinforce, reorganize his knowledge, technique and skills in industrial arts, (7) written and oral communication, (8) acquaint with advancements in industrial processes, (9) meet the needs of the individual, (10) present technical developments in manipulative areas of industrial fields.

I recently saw a publication of the U. S. Government Printing Office titled "Teacher Education Fifth Year Program: A Selected Bibliography." This contains a list of 153 studies dealing with the fifth-year program. Some will scorn this publication as a resource tool because it is dated 1959.

I read some of these contributions and found them most provocative.

If the graduates of the master's degree programs are to go, as I assume they will, into policy-making posts as deans, professors, and supervisors of industrial arts curricula, one of their major functions will be to determine curriculum content at the particular school level where they are employed.

Basic questions of curriculum require educational statesmanship, and presumably, it may be the function of the graduate program to develop this kind of statesmanship.

Or is it the graduate program's responsibility to produce the other essential ingredients, which is superbly trained teachers for whatever courses are decided upon? Can the program attempt both goals?

This depends on what kinds of people you prepare for what kinds of positions. On this matter I have no reliable information.

Dr. Merritt A. Williamson, Dean of the College of Engineering at Pennsylvania State University, in an address last month called for a new type of engineer who would "not go on strike against airlines, or picket building sites, or repair television sets, or set up and arrange equipment for radio or television broadcasts, but a professional man who would work for the benefit of mankind and live up to the standards set by the licensing boards of the 50 states."

The Dean stressed that the engineer is a professional man who needs an education of an intellectual nature. "He must work for more than just remuneration. He is ever conscious that as a trusted public servant he has a concern for the life and safety of the society he serves. He subscribes to a code of ethical behavior and he must pass examinations to demonstrate his practical competence."

This states an ideal that most of us share, not alone for the engineer, but for everyone who works or teaches in the industrial arts field. However, this statement bothers me a little.

With apologies to the dean, with whom I am not acquainted, I cannot avoid a feeling of smugness and a weird assumption that professional people have a monopoly on service, while union-oriented workers are just self-seekers.

Frankly, that does not reflect my notion of democratic ideals.

I have a distinct feeling that the worker who makes no pretensions of being professional, who does not go to college and who does not have a printed code of ethics and who may be a militant union worker, may have as much of a spirit of service and as strong a sense of ethics as the holder of a master's degree.

As you know, Willard Wirtz recently proposed a general extension of public schooling, with nationwide requirements of school attendance to age 18, public junior colleges, vast networks of technical institutes, and upgrading of the high school vocational courses. If these proposals are adopted, there would be need for more very well-trained industrial arts teachers.

Let us return to the question of the basic purpose of the graduate program in industrial arts. What do we expect the recipients of the post-baccalaureate program to do or be? I have an unsupported hunch that most persons have ambitions for administrative responsibility.

One of the qualities we must promote in our master's degree students is that kind of educational statesmanship that makes them receptive to creative thinking, that makes them able to recognize and encourage constructive innovations even when they are incapable of producing it themselves.

Conferences are frequently discouraging because we go home saying, "We didn't get any answers." To the questions that count, and the structure of a graduate program is a question that counts, no one can give out answers. We each must formulate our own.

The College Student Program

KENNETH Van Buskirk, State University College, Buffalo, New York, was the leader of a discussion group, which considered two questions. The first question, "Should Industrial Arts programs require five years for a bachelor's degree?" was decided in the affirmative by the group. The group concluded that five years were necessary or else the amount of subjects taken should be lessened.

The group decided in the negative concerning the second question, "Should Liberal Arts be on the same level as Industrial Arts?" It felt that Liberal Arts were less important because Industrial Arts was the main purpose and should receive greater attention. It was agreed that the purpose of Industrial Arts is not to teach the mechanical process, but the theory behind it.

* * *

The question, "Should Industrial Arts graduates be certified to teach only in two areas?" was decided in the affirmative in another group discussion. This group felt it was difficult to maintain a high degree of competency and efficiency in more than two areas at the senior high school level.

The group decided that at the junior high school level teaching more areas is justifiable. Teachers are not called upon to present highly technical material.

* * *

Ralph Womeldorf, Old Dominion College, Norfolk, Virginia, was the leader of the group, which discussed the question, "Are Liberal Arts courses really necessary in the preparation of Industrial Arts teachers?"

The group decided that the number of Liberal Arts courses should be increased even if it meant dropping some Industrial Arts courses. It was felt that this should result in better educated teachers who fit in better with the rest of the school faculty.

The group suggested that more specialization in fewer fields of Industrial Arts would allow the pursuit of more Liberal Arts courses.

* * *

The discussion of the question, "Should a degree in Industrial Arts be recognized as a certificate to teach Industrial Arts in every state?" was led by Arthur A. Cohn, State College, California, Pennsylvania.

The group decided in the affirmative, but only on the junior high school level.

This group also discussed the question, "What is Industrial Arts and what is Vocational Education?" It defined Industrial Arts as that phase of general education, broad in scope and shallow in depth, whose purpose is to introduce students to the various technical aspects of our culture. It is not intended to provide the individual with all the knowledge necessary to make the student proficient in any specialized field.

* * *

In the group considering the question, "What Industrial Arts courses should be included in the curriculum of a modern high school?", a definition of Industrial Arts was first discussed.

Definitions included the orientation of the student to the various phases of an industrial society. It was suggested that the program should not place emphasis on the individual shop, but on the total manufacturing process as it progresses from one shop to another.

Melvin Schneider, University of Maryland, College Park, Maryland, was the group leader.

Dr. Paul W. DeVore, *Director*
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NEW DIRECTIONS IN HIGHER EDUCATION

INDUSTRIAL arts purports to be knowledgeable about industry and technology which serves as the foundation for the curriculum, but at the same time seems unable to adjust to the changes wrought by technology.

In the future less and less production work requiring manual skill will be done by individuals. There will be an increased emphasis on the knowledge of principles and understanding and the use of personal judgement.

The human role will be decision-making, planning, discovery, design, and creativity with all jobs calling for more initiative and responsibility.

A review of college catalogs for both the undergraduate and graduate programs together with information from placements requests describing openings in teacher education programs indicates our professional preparation of teachers is out-of-date.

A field purporting to prepare teachers to educate youth for a future in an industrial-technological society has failed to adapt to change.

A review of curricula in higher education shows little attention devoted to the actual study of the concepts of technology on the undergraduate level.

On the graduate level almost no quality laboratory coursework is offered particularly at the doctoral level. We still permit a proliferation of minor field of study in areas which are only remotely related to the task at hand.

To solve these problems we must recognize our field as a discipline in its own right. We must identify the major or core areas of technology to which we will give attention. Consideration should be given to the establishment of three major areas of study for all industrial arts students in higher education. These are the professional core, the technical core and the technology and culture core.

Technical and laboratory programs should be designed on both the masters and doctoral levels in order to provide our profession with practitioners, who have a depth of technological knowledge and ability in several core areas. The technical masters and doctoral programs should provide more time for technical research of both the directed and independent types.

To provide for this type of program requires a new concept of graduate study based less on units of credit and more on competency.

At the masters level, the resident internship offers possibilities for the preparation of quality teachers. The program should be designed to assure the student of attaining specific learning experiences in the technical areas while serving as interns with highly competent professors in several technical areas.

This phase of graduate work could include a directed field study providing the student with valuable experience concerning the nature of American industry. At the doctoral level a portion of the program should include a directed field study in American or European industry.

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INDUSTRIAL DEVELOPMENTS AND THEIR IMPLICATIONS FOR INDUSTRIAL ARTS

COLD TYPESETTING

COLD typesetting is a broad term lumping together everything of a non-metal typesetting character. There are three basic categories.

1. Photographic typesetting
2. Display composition
3. Typewriter composition

PHOTOGRAPHIC TYPESETTING

Fotosetter.

The Fotosetter is a photographic line composing machine manufactured by Intertype Corporation, Brooklyn, New York. (One of the first of this kind.)

The Fotosetter is an automatic, photographic line composing machine. It produces justified composition in galley form directly on film or photographic paper in one operation. This composition can be reproduced on offset-lithographic, gravure, and letterpress plates, using standard platemaking methods in each case.

The Fotosetter employs the same time-proven circulating matrix used by the Intertype line-casting machine. In place of a metal pot a camera is used. The camera operates on the letter by letter principle of photographing each character object individually.

The matrix carries the photographic negative character. This character is imbedded in the side of the matrix. Spacing is controlled by the thickness of the matrix body.

The justification mechanism automatically measures a composed line of matrices for the amount of space which must be distributed to effect justification. This space is automatically distributed between words and characters throughout the reproduced line.

This machine produces enlarged or reduced type sizes without changing magazines. Eight prefocused lenses are mounted in a lens turret. The operator turns the indexed turret dial to the type face size he wishes to produce.

Two fonts of matrices of a basic type design cover the usual range of type faces from four to thirty-six points. With eight lenses the camera will produce as many as eleven different type face sizes from the two basic fonts.

Proofs can be made by exposure of the film composition in any type of printing frame or blueprinting machine.

Linofilm.

The Linofilm is a complete photo-composition system embracing make-up as well as typesetting and correction. It is made up of four parts, a keyboard unit, photographic unit, the corrector, and the composer.

The keyboard unit prepares a punched tape plus a typewritten copy on paper. The tape contains the information needed to activate the photographic unit. Eighteen different font grids are made available by the right-hand control panel. The left hand control panel controls the machine functions, such as justification and line erase. The operator types until the justify button lights. She then depresses this button and the machine automatically justifies the line.

The photographic unit produces an exposed, undeveloped photographic film positive. The machine operator feeds the punched tape from the keyboard unit into the photographic unit. It sets the materials as recorded on the tape. After tape has completed its run, the film advances into a light proof container. The film is developed in the darkroom.

Film correction is done by placing the film to be corrected in one galley and the film with the corrected lines in another galley. The Corrector is set for the type of correction desired, as replacing an entire line or paragraph. The machine automatically removes the incorrect lines and welds the correct ones in place.

The Composer performs make-up and enlarging. It produces positive type on film or paper. The working surface is about the size of a newspaper page.

The Composer photographs the galley line by line and alters its position to conform to a layout. It will enlarge or reduce the copy somewhat. This readjusted film positive is then ready for platemaking.

How can the Industrial Arts teacher offer such experiences?

The Protype Division of Electrographic Corporation have available a complete cold-type composing department for about $600.00. This system sets type, squares it, letter and line spaces copy, aligns it right or left and provides finished mechanical or copy for a paste-up. It is available in 1,500 different type faces from 6 point to 90 point.

TYPEWRITER

The typewriter is a piece of cold-type equipment readily available to the

Industrial Arts instructor. Standard machines lack the quality of printed type and each character takes up an equal amount of space resulting in lines of copy that are too loose or too tight.

Available are typewriters which have proportional spacing fonts. Each letter in the alphabet is given the amount of space required for good visual appearance and legibility.

Some brand names are the Varityper, Justowriter, and I.B.M. Executive.

The Varityper requires that lines be manually typed twice. Once in a rough draft and then justified automatically on the second typing.

The Justowriter consists of two machines. One is a recording unit with a standard typewriter keyboard. The operator types from the original copy in the usual way producing typed copy of unjustified lines. A perforating device punches a tape with a code for each character. When the type is completed it is fed into a second machine called a reproducer which reads the tape, incorporates predetermined corrections, justifies the lines and types them on a sheet of paper.

The I.B.M. Executive is very much like a standard typewriter except it can justify the right hand margin. The copy must be typed twice with semi-automatic justification taking place during the second typing.

Inexpensive cold type photo machines are available which provide type on sensityped paper or film. These machines can be used to produce type matter for artists' paste-ups and not for straight copy.

Three such machines are the Headliner, Filmotype and Protype. The Headliner is a self-contained composing and developing unit. The composition is done by dialing the desired sequence of characters. Exposure, developing, washing, and fixing are automatic.

The Filmotype prints on a two inch wide strip of film or paper. A dial moves the characters past a selector mark where they are positioned for exposure. The exposed proof is separated from the remaining roll for developing.

The Protype is a manually operated photo composing unit. The fonts are Mylar film negatives which are moved along a track to position the characters. A hand held lamp exposes the selected characters to a roll of film or sensitized paper.

HIGH ENERGY FORMING METHODS

High energy forming has become of great importance because of its application to the forming of high-strength, high-temperature resistant materials. The methods used are explosive forming, drop-hammer, trapped rubber and floating piston systems, hot fluid, and integrally heated die forming.

Drop-Hammer Forming and Trapped Rubber Forming.

These are conventional methods of high energy forming. They utilize the principle of large mass to provide energy more than the velocity of the die.

Floating Piston Forming.

The floating piston forming makes more use of velocity than drophammer trapped rubber forming.

High Velocity Forming.

There are several systems for high velocity free bulge forming. These are explosive forming, electro-magnetic forming, gas forming and electrical-discharge forming. In high velocity systems such as these the total energy contributed toward forming is almost entirely due to the velocity rather than mass.

Explosive Forming.

The one main advantage of explosive forming is the tapping of a low cost source of energy. If a part can be formed better and cheaper by explosive forming it should be used. It does permit the fabrication of one-piece components that normally would require joining several small parts.

Commercial explosive forming is done by clamping a work piece to the die, removing the air between the die and the work piece and lowering the assembly into a water-filled pit. An explosive charge, such as dynamite is lowered into the pit and set off. The water transmits the pressure set off by the blast to the work piece. This pressure could equal or exceed a million pounds per square inch.

Explosive forming is cheap. Practically any metal can be formed this way. It is an out-of-doors activity and usually performed far away from settled areas. Fifty cents worth of high explosive releases more force than the largest presses available.

The explosive charge usually forms the piece in one shot which press forming may require many draw operations with annealing in between draws.

By properly shopping and locating the explosive, its shock wave, and the work piece, the thickness of the finished piece may be varied as desired and where desired.

A variety of explosive forming is explosive welding. This is done by ramming two cleaned metal surfaces together under opposed explosive charges, which fuses the surfaces together.

Some industrial arts teachers have been working with explosive forming on a small scale. An article appeared in the September 1961 issue of School Shop magazine. We have had a student working with this trying to develop a unit for classroom use.

The unit he is developing consists of a metal tank, water, a female die, a vacuum beneath the work, an dan explosive. The die will be steel. We are going to experiment with other die materials including plastics.

It is necessary to maintain a seal between the workpiece and the die to contain the vacuum and to prevent the water from filling the cavity.

The vacuum permits the work-piece to reach the die surface and prevents the burning of the surfaces due to adiabatic heating of the entrapped air.

The tank of water should be large enough to permit a substantial head of water and the vertical walls should be set at a distance that will prevent them from deforming during the forming process.

Various types of explosives have been used. The type depends upon the application. Explosive experts need to be consulted. The explosive should be stable enough to permit handling and have a high detonation rate. We will probably use a 38-caliber cartridge. Other explosives are under consideration.

Electric-Discharge Forming.

Electric-discharge or spark forming is a type of metal forming in which a massive electrical discharge from a bank of capacitors sends a shock wave like a lightning bolt through water to form metals against a die. This operates much like chemical explosive forming.

The impact is caused by jumping a spark across the gap between two electrodes or exploding a tiny filament or budge wire connecting the electrodes.

Spark forming is more expensive than explosive forming because of the need for a large bank of capacitors. However, it does not present the hazards of explosive forming and can be done inside a plant.

Presently spark forming is limited to parts one to two feet in diameter. The size of the chamber and electrical charge available are restricting factors.

The tank of water should be large enough to permit a substantial head

Electro-Magnetic Forming.

Electro-magnetic forming involves the use of a magnetic field to bend metals. A large insulated induction coil is either wrapped around the work piece or whitin it, depending upon whether the metal is to be squeezed inward or bulged outward. The electrical charge is drawn from a bank of capacitors. The opposing currents in the coil and metal produce a strong magnetic force that repels and deforms the metal.

This is a dry process. The loading and unloading of the work piece is easy. Only one commercial machine is on the market. It produces 50,000 pounds per square inch.

Gas Forming.

Compressed gas is used to either directly bend the metal or drive a ram into the work piece to form it. Such a machine can forge, extrude and compact metal. There are only two machines on the market. One uses a single ram and the other two rams, one from each side. They meet at equal velocity thus taking some load off the frame and transferring it to the work piece.

High-Temperature Forming.

The two basic type systems for using heat for high energy forming are integrally heated die forming and hot fluid forming.

In integrally heated die forming the heat is supplied to both metal die halves by cartridge type heaters. The entire die is surrounded by insulation. The temperature used approaches 2,000°F.

Heat supplies 90 to 95 percent of the energy required in forming with high-temperature forming methods. Of course, metallurgical considerations must be such that they will not prohibit forming at the high temperatures necessary to reduce the stress to a low level. For example, a stainless steel sheet having a flow stress of 100,000 psi at room temperature will have only 5,000 psi flow stress at 1,200°F. It can be seen that this greatly reduces the mechanical energy necessary to form the material.

NEW MATERIALS IN DRAFTING

Intermediates.

Consider the use of *intermediates* in industry. An intermediate is a translucent-based reproduction master printed from an original drawing in order to permit modification and to serve as the basic source of printmaking.

Basically, here is what happens with one type. The original pencil or ink tracing is fed through an ammonia process print machine on top of a piece of intermediate film, much the same as a diazo type print. The intermediate is exposed to the light source and developed by the ammonia. This intermediate print can now be used as a translucent master for reproducing copies of the drawing and the original tracing is filed and preserved. The intermediate generally gives a better print than the original tracing.

Liquid eradicators are available for making line deletions on intermediates. This has several adaptations in industry. For example, if a change has been made in a design, a draftsman can run an intermediate copy of the tracing, eradicate the portions to be changed and draw the changes on the intermediate. It is then ready to produce copies of the revised print and the original tracing has not been damaged and can be filed for reference.

Corrections and changes involving large areas can be made by running an intermediate and then cutting away the portion to be deleted, running a second intermediate and drawing in the corrections. Also the process of masking out unwanted portions of a drawing can be used (good article in *Graphic Science Magazine,* January, 1961, page 20).

Intermediate copies are not expensive and can be easily used in the school classroom.

Pressure Sensitive Tape.

Another industrial development is the use of pressure sensitive tape. The types of tape sold are in wide array. It can be purchased in strips of various widths, in templates of machines, structural steel shapes and an endless variety of other forms. Also available are sheets of grid paper upon which the pressure sensitive tape can be applied. Office layouts and factory layouts can be made accurately without touching a drawing instrument. Charts, graphs, and many other visual devices can be made. It is fast. Some people call it scissors drafting. One outstanding use is the layout of electric circuits.

Polyester Film.

An increasingly popular new drafting medium is the polyester film. This film gives tracings that can be washed when they are dirty. It is almost impossible to tear it or damage it. It has been subjected to many tests. It was even taped to the floor and a swivel chair rolled over it all day without damaging the surface. Heat, cold, and liquids do not bother it. To insure that lines will not wash off, the draftsman must use plastic pencils.

Microfilm.

Another process influencing the drafting in industry is the use of microfilm in the miniaturization of drawings. Miniaturization means reducing a drawing through a photographic process onto microfilm. The common size films used are 35 mm, 70 mm, and 105 mm.

At least one company manufactures a camera-projector which combines the features of the 35 mm and 105 mm systems in a single machine. The 35 mm system produces small negatives for record copies, half size prints, and automatic and semi-automatic filing and reproduction.

The amount of time saved by microfilm is tremendous. The space saving is equally significant. It is now possible to store 100,000 drawings in only four square feet of floor space.

The following is how a typical 35 mm miniaturization program might work. A company may develop or receive from another company drawings pertaining to a product. If these are to be used frequently or are to be filed permanently, they will be reproduced on microfilm. These microfilm cards are then filed. In existence are mechanical and manual filing systems. The mechanical machine called EAM (electrical accounting machine), punches a card containing all pertinent information. The key-punched card is used to produce as many duplicate decks of cards as necessary. The microfilm is then mounted into this punched accounting card.

This key-punched card used in this microfilm system contains an accurate, engineering drawing combination with all pertinent information ready to be sorted into any desired sequence, reproduced, filed, and retrieved with utmost efficiency by high speed electrical accounting machines. The saving in time is enormous.

Many contractors are now supplying the government with microfilm cards instead of the drawings for the thing upon which they are bidding.

To produce a microfilm card on paper, an automatic, continuous electrostatic printer is available. It reproduces at the rate of twenty feet per minute. This machine also automatically clips off each drawing as it leaves the machine.

Viewers are available which enable a person to scan a microfilm drawing. They can blow up a drawing to approximately 18 x 24 inches.

Copies of the microfilm card can be made on a machine which will produce up to 600 copies per hour. This means that the drawing can be quickly copied on microfilm and sent to other departments or other companies.

The 105 mm system yields negatives and enlargements in precise detail from the largest engineering drawings.

The 105 mm system is used a great deal to copy old, large drawings. It can copy damaged, soiled and faded drawings and save thousands of dollars in re-drawing time, reproduction time and storage. It produces copies with a high degree of uniformity even though some are ink and others are pencil and are drawn on different qualities of paper and drafting film. For example, a damaged set of drawings can be put on microfilm and copies reproduced full size, half size, or some other reduced size in a matter of minutes. Speed as well as uniformity is the important contribution of microfilm.

A good example illustrating how the 105 mm system can work is to cite its use by the Washington D. C. Transit system. They needed a map for a new route for an express system. It was planned to use a draftsman to piece together parts of various maps into a master map 39 feet long. The available maps were on a variety of materials and to a variety of scales. It was estimated it would take the draftsman six months to complete the job. Instead, a 105 mm microfilm system was used. The available maps were microfilmed and reproduced so the camera projected them at a common scale. The entire map was reproduced in six hours.

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INDUSTRIAL DEVELOPMENT AND ITS IMPLICATIONS FOR INDUSTRIAL ARTS CONTENT

PERHAPS a more appropriate title for this discussion would be "We Old Dogs Better Learn New Tricks."

When I was in college between 1939 and 1943, Industrial Arts was woodworking, metalworking and drafting. Today electronics, power mechanics and graphic arts are crowding these more traditional subjects to the point where some schools don't even include some of these in new programs brought about by new buildings and consolidation.

One of my students recently asked, "What is happening to woodworking? They are building a new school back in my home town, and there is no provision for a woodworking shop."

Now, I can only speculate, as I did in answering this student's question, but the best guess is that the instruction in woodworking in their situation was so antiquated that the school planners couldn't conceive of it as belonging in a modern school complex.

Even the most naive would look skeptically at the instructor who only recently was requiring every youngster to bring an old broomstick from home to be converted into a laundry stirring stick for the back yard laundry kettle. The instructor who only a few years ago was requiring every student in his class to forge a single tree hook in his metalworking class only contributed to such skepticism.

These conditions are extreme in specific example only. Similar examples could doubtless be drawn from other facets of our total technical program. The important thing is that, broadly speaking, our programs probably lag many years behind the progress of industry we claim we teach.

Exciting things are happening in every facet of industry represented by the various segments of our industrial arts content. These developments offer new opportunities to industrial arts teachers, for the enriching of our content through the addition of new technological concepts could help us to challenge the students, and also, perhaps, cause a reappraisal by those critics who only three or four years ago, through a survey by the NEA, suggested industrial arts as the subject least needed in public school curricula.

SOME RECENT TECHNOLOGICAL DEVELOPMENTS

ELECTRONICS

Rapid Expansion of Utilization of Simple Principle of Ionization

One of the major problems confronting man today is the elimination of dust, pollen, smoke, airborne micro-organisms, etc., from the air. Electronics is now being used to remove these particles automatically and economically by making use of a simple principle of science called ionization. One such piece of equipment called a precipitron, is in operation in a home heating system, removing 96% of all particles in the air. If you recall, ionization is the removal of an electron from a normal molecule, leaving the remaining unit as an unbalanced positive charge called a positive ion. By passing molecules (dust particles) through an electrostatic field, they become positive ions and are attracted to negatively-charged collector area, thus cleansing the air.

This is just one more example of the importance of electronics in twentieth-century living. It implies industrial economy as well as individual health and comfort, both at work and in the home. Such knowledge is of general educational value, and also, may have some guidance value for students interested in occupations related to electricity and electronics.

The field of electronics is almost symbolic of the word change. Such terms as semi-conductors, miniaturization, computer science and transistorized ignition suggest challenge for those working in this area of industrial arts.

ELECTRICITY

The Fuel Cell

The Western Union splice was about my greatest achievement in industrial arts electricity. Today's youngsters learn how space communication systems are powered by solar energy, and how electrical energy produced directly through chemical reaction can provide noiseless propulsion for a tractor. This simple means for generating electrical power, known as the fuel cell, promises to displace the internal combustion engine in automobiles.

Again, as in the case of electronics, those persons who teach electricity have their challenges set up for them just to keep up with such developments as slow-running motors, cryogenics, laser energy, ion engines and thermionic omission.

WOODWORKING

Abrasive Planing

Machinery is being manufactured to utilize the 3M Company's newly developed thickness planing abrasive belt. Cuts up to 3/16" can be made without the tearing effect of the conventional thickness planer.

Water Jet Machining

Largely experimental yet, water jets under extremely high pressure have been used to machine wood. This extremely small jet severs the wood with a neglible loss of wood compared with sawing. There is no maintenance of tools.

FINISHING

Ultrasonic Cleaning

Cleaning of component parts is a major problem in the metalworking industry. In the process of ultrasonic cleaning, countless numbers of tiny bubbles are made to form on the surface of objects submerged in an agitating bath. High frequency sound waves are used to "implode" these bubbles, causing extreme forces to blast impurities from even the most intricate parts.

Electropharetic Painting

Water-thinned paints are deposited on metal surfaces somewhat as metal is deposited in electroplating. In addition to the obvious advantage of eliminating fire hazards, waste, and worker discomfort, a very uniform coating is possible.

CASTING OF METALS

Full Mold Casting

The full mold casting process utilizes foamed polystyrene plastics as a pattern material. Such patterns are classified as "gasifiable," and are not removed from the mold. Instead, they are vaporized by the liquid metal and are replaced in the mold by the metal. This type of molding technique is economically feasible only for one or a very few castings, since the pattern is lost each time.

Sonci Testing of Castings

Variations in wall thickness of gray iron bathtub and lavatory castings are detected by a portable ultrasonic instrument. Such detection is critical, for thin spots can cause severe problems when castings are heated for enameling. As many as 68 thickness readings are taken on a casting, at the rate of one per minute. Prior to the ultrasonic device, castings were broken and wall thickness was measured with calipers. This measuring procedure with the new ultrasonic instrument is also used to measure wall thickness in patterns as they are built and rebuilt.

CERAMICS

Electronic Ceramics

Substrates for electronic components are increasingly made from ceramic materials. Extremes of temperature have minor influence on the functioning properties of such components.

Strength, wear resistance, corrosion resistance, shock and heat resistance, heat dissipation, thermal conductivity are but a few of the properties of ceramic materials.

Foamed Ceramics for Space

The solution to the problem of weight was achieved through foamed ceramics for aerospace applications. But, as is so often the case, solving one problem creates another. Special means had to be devised for machining these foamed ceramics.

MATERIALS JOINING

Resistance Welding of Glass to Glass

Glass, normally highly non-conductive, is made conductive by heating to high temperature. Electric current can be introduced to cause glass parts to weld instantly at the point of contact without distorting the whole object through the usual fusion methods.

CONCLUSION

We simply must reflect the new things that are happening in industry. Stirring sticks must give way to experiments in controlling the stability of wood products. We can't train tomorrow's industrial and scientific leaders with yesterday's methods and content.

The graduates of many good industrial arts programs will depend on what they learn in school to open a door for them into the industrial world. It is our responsibility to see to it that this training has the best possible similarity to the situations they will encounter in the world of work. Maybe we should look hard at our use of project kits, our "canned" procedures, our bread board techniques as instructional media. We might gain a lot by confronting our students with more perplexing challenges, situations, and problems taken directly from live industry.

This might be achieved if the instructor would visit more industries and seek the help of industrial personnel. Also, much might be gained if we would subscribe to more technical journals and join more technical societies. Those who do this should take it upon themselves to write more technical materials for the professional journals.

In our content we should exchange some of our *tinkering* for more technology; and, in our methods we should give up some of our *projects* in favor of more *problems*.

Those "young dogs" who come up to us "old dogs" for instruction had better not be taken too much for granted in terms of what they know. They are being bombarded by a set of alphabetic symbols much as we were in the late thirties. They are likely to have been exposed to such as LASER, PEG, MIG, TIG, HERF, ECM, EDM, and the like. Will we, as industrial arts teachers, teach them the full meaning and the implications of these new technological developments? The answer may have a great influence on the future of industrial arts.

JAMES E. GALLAGHER, *Assistant Professor*
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A NEW CONCEPT OF INTERPRETING PRODUCTIVE SOCIETY TO YOUTH— A DESCRIPTION OF THE ZIEL PROGRAM OF INDUSTRIAL ARTS

WE are convinced that this program, conceived and implemented by Dr. Henry R. Zeil, professor and head, Department of Industrial and Vocational Education, Faculty of Education, University of Alberta, has a valuable contribution to make to the field of industrial arts education, regardless of local conditions and geographical location.

I will describe the program under five headings. The first concerns the objectives of Industrial Arts. Dr. Ziel's four objectives are (1) to develop an understanding of the productive aspects of society; (2) to provide exploratory experience through an introduction to the various technologies prevalent in the world of work and the interdependence of these technologies; (3) to reinforce, integrate, and faciliate application to the academic disciplines in a synthesizing educational environment; (4) to provide an introduction to the multiplicities of occupational opportunities.

These objectves perform three important functions. They establish the purpose of the industrial arts program. They indicate the relationship of industrial arts to general education. They also indicate the subject matter for industrial arts.

The second heading concerns the organization of the Ziel Program of Industrial Arts. It is divided into four levels or phases. Each phase, recommended for boys and girls, is conducted in a multiple-activity laboratory.

A well-planned and equipped multiple-activity laboratory accommodates all four phases of this program. There are two distinct areas in the designing of the laboratory. Two instructors are required to teach the total program.

The initial phase is an introductory and exploratory level recommended for grade seven students. It provides an introduction and develops appreciations for tools, machines, and materials.

Electricity, graphic arts, ceramics, plastics, woods, and metals are the industrial material areas included in this phase.

Each student participates in learning experiences from each of the six mentioned areas during the school term.

The second phase is recommended for grade eight and nine students. As in phase one, each student, through a multiple-activity laboratory organization, is introduced to each of seven basic technologies.

These encompass electricity-electronics, computer technology, mechanical technology, power technology, power transmission, graphic communications, and materials and processes technology.

The third phase is an activity level in which grade ten students produce a product or service. The program at this level is primarily concerned with developing understandings by participating in a simulated organization. In short, the initial year of the senior high school program is devoted to a study of the sociological components of industry.

Grade eleven and twelve students study a combination of technologies at the fourth phase level. Two or three of the technologies explored in phase two are studied in depth during the final two years of senior high school.

The systems approach to selecting content is the third heading. Selecting content for any subject area in the curriculum is a difficult process. It includes experimentation, analysis and experience. But it is chiefly one of judgement.

Three frames of reference were established for the selection of content for the Ziel Program. They state that all content is selected on the basis that it will lend itself to the achievement of the stated objectives. The second recognizes that the experiences of the students are highly structured, permitting virtually no deviation from the basic learnings considered mandatory for the achievement of the objectives.

The third frame of reference is that the content selected provides flexibility or differences in student abilities, interests, and needs.

The second and third points seem to contradict each other, but they actually do not. These points assume that certain experiences and learnings, which are basic, should be undertaken by the student. Then, the individual is provided with additional learnings and experiences.

Next, let us consider the physical layout of the Industrial Arts Laboratory. It was previously mentioned that there are two distinct areas in the design of the laboratory necessary for the Ziel Program to function.

There are, in fact, three areas, which include the six industrial materials areas, the seven technologies area, and a common instructional materials center which serves as a conference and resource room.

The two laboratory areas have approximately 1,500 square feet each, necessitating a total square footage of approximately 3,200 square feet.

The layout of the two laboratories is identical in principle, so a description of one will suffice.

Finally, we come to the initial evaluation of the Ziel Program. To say the philosophy of the program and the pilot projects have been accepted is an understatement. The junior high school Industrial Arts curriculum in the Province of Alberta is being revised along the lines of the program. It is being introduced throughout the province on a transition basis beginning next September.

The senior high school Industrial Arts curriculum is scheduled to be revised next year.

We realize that certain situational factors in the educational environment in Alberta made it possible for this program to be accepted more readily than might otherwise have been the case.

The Federal government made millions of dollars available to the provinces for the establishment of vocational education facilities. This demanded that a clear distinction be made between industrial arts and vocational education. At the same time, the subject area of industrial arts was being gradually eased out of the secondary education curriculum, partly because of pressure to add additional subjects to the curriculum. This was also because the conventional program of woods, metals, and drafting could not be justified as a general education subject for all youth.

Perhaps similar situational factors exist in the areas from which you come.

Many things need to be done and many problems remain to be solved with regard to the Ziel Program. We do not profess to have all of the answers.

Warren Smith, *Coordinator*
of Technical Science
Nova High School,
Broward County, Florida

THE SCHOOL OF TOMORROW, TODAY!

NOVA High School, which opened in September, 1963, is one of two initial units of the South Florida Education Center—an educational complex imaginative and advanced in concept.

Eventually the complex will house a group of tax-supported schools encompassing kindergarten through junior college. Also planned is a privately-operated university, the Institute of Technology, which will offer four years of senior college plus graduate degrees in education, engineering, sciences, and related technological fields.

This long-range program, when completed, will present a continuous integrated process of learning unparalleled in educational history. In its entirety this bold departure from "traditional schooling" is known as the "Nova Plan." Nova High School is its working blueprint for the future.

What makes Nova different? It is not experimental in curriculum, but in concept. Its construction features, equipment, teaching aids, and instructional methods have been tested and proved individually in other school systems.

Its uniqueness lies in the fact that for the first time anywhere, all of these proven procedures are being brought together with excellent teachers and superior buildings for maximum efficiency. The environment is adapted to suit the educational program. The program is not restricted to conform to physical facilities.

Nova is a space-age school. Its primary purpose is to utilize scientific methods of learning in a scientific age. Yet in its basic philosophy, it represents a return to fundamental education. This emphasis on fundamental education demands more from students in both time and effort. In the words of Arthur B. Wolfe, director and chief planner of the Nova Plan, "Attending Nova is a full-time job for all students."

Operating on a trimester system, Nova has lengthened both the school day and year. There are five regular class periods, each 70 minutes long. In addition there is an optional hour in the school day when students may do research or participate in noncredit activities such as clubs, vocal or instrumental music training, school yearbook and newspaper activities, driver training and interscholastic athletics.

The school year totals 220 days—40 days longer than the national average, 40 days longer than required by Florida law, and 25 days longer than any other public school system in the country. All students are required to take English, mathematics, science, a foreign language, social science, technical science, and physical education each school year.

Despite the seeming rigidity of this curriculum, there is flexibility within its framework. With an educational program truly tailored to individual needs, Nova brings into practice the theory of "taking each student as far as he can go."

Nova is a nongraded school. In its first year of operation, year levels seven through ten are included. Within the next two years eleventh and twelfth years levels will be added.

Instead of being "promoted" a grade each year, students will progress through a series of achievement levels in each subject area. As a student masters one level in a course, he may continue to the next on any day, week, or month of the school year. The speed of his advancement depends upon his capabilities and interests. This same nongraded system will be followed when elementary schools are constructed and begin operation under the Nova Plan.

Nova includes a cross section of students and not just those who have above average intelligence. The program is designed to meet the critical needs of each student. However, since each level must be mastered in turn, no one can fail and no one will be required to repeat an entire year's work in any subject. Talented students who progress rapidly may be graduated early with faculty permission. However, no one will be graduated in less than two and one-third years above the ninth-year level.

Students should anticipate no difficulties in meeting college entrance requirements since graduates will have completed four years of each basic subject as well as additional electives.

Both parent and student reactions to this new and stimulating instructional environment have been overwhelmingly favorable. Because of Nova's unique nature, students are accepted on a voluntary basis. Currently there is a long waiting list of applicants for enrollment next year.

This enthusiasm prevails despite the fact that students must provide their own transportation or pay bus fare to and from school, pay a fee to defray expenses for additional instructional materials and automated teaching devices, and purchase special textbooks not available from the state sources.

In nearly every way, Nova might be termed a "do-it-yourself" school. "Understanding" and "self-motivation" are key words in its educational program. The curriculum is designed to teach students the "how" and "why" as well as the "what." Independent research is encouraged in every possible way so that students may learn to take pride and pleasure in stimulating study.

Mr. Wolfe sums up his educational philosophy this way:

"The student must learn to identify and analyze problems, gather relevant information, develop and test plausible solutions, and evaluate outcomes. Anything that is only partially learned is of little use either in dealing with practical matters or as a stepping-stone to further learning.

"As educators we have a serious responsibility, too. Students go through the public school system only once. If we don't give them the best possible education, do the best job we can do, we have deprived them of something to which they are entitled and can never find anywhere else."

Nova is trying to do "the best job it can" by utilizing the very new teaching techniques, combining and adapting them to suit individual programs, and constantly striving for improvement.

Students have the benefit of exceptionally well-qualified teachers who are able to devote all their time to teaching. Teacher aides assist in the instructional program and clerical assistants take over paper work thereby relieving instructors of time-consuming chores related only indirectly to the actual process of teaching. Team teaching is utilized effectively in selected subject areas.

Classrooms have been constructed with movable partitions so that students may study in large or small rooms, as the day's activities dictate. Work space also has been provided for small discussion groups and for individual research.

Keeping abreast with the electronics era, Nova is a prime showcase for automation. A closed-circuit television system will not only permit telecasts throughout the school, but will allow video tapes to be made of lessons and lectures for use at later dates. Overhead projectors and tape recorders are installed at all teacher centers.

The traditional library has been replaced by resource centers, located in the language arts and science buildings. Here, reference books share space with tape recorders, microfilm readers and teaching machines.

Expensive? Yes. But these instructional aids did not boost Nova's over-all cost. Neither did such items as air conditioning, carpeted floors, and special acoustical materials—all of which combine to make an atmosphere more conducive to learning.

These innovations were financed by the omission of facilities which long have been considered standard equipment in conventional schools. Nova has no large assembly-type auditorium, no huge spectator-sized gymnasium, and no expensive kitchen and cafeteria. Students either bring their lunch or purchase food at snack bars, supervised by a dietitian, and eat in a protected outside dining area.

Nova already has become an educational showcase in its own area, Broward County, as well as the nation. Many of its ideas and procedures will be incorporated in new schools and adapted to existing plants throughout the county and the country.

Nova's goal: To provide the best possible education at the lowest practical cost.

Stephen Johnson, *Supervisor*
Industrial Arts,
Broward County Florida

A PROGRESSIVE INDUSTRIAL ARTS PROGRAM IN BROWARD COUNTY, FLORIDA

BROWARD County is situated in the southeastern part of Florida and is located between Palm Beach County on the north and Dade County on the south. The principal cities in Broward County are Hallandale, Hollywood and Dania in the south; Fort Lauderdale in the central portion; Pompano Beach and Deerfield Beach in the north.

The population which has been scattered along the coast is very rapidly pushing to the west, and towns such as Miremar and West Hollywood in the southwest; Plantation in the West Central, and Margate in the northwest section are growing rapidly.

The total school population is 77,882, and the breakdown is as follows: 43,819 elementary—19,266 junior high—14,290 senior high (giving a total of 33,556 in secondary which is comprised of 17 junior highs and 10 senior highs). Included in this 77,882 figure, we have 393 in the Exceptional Child Center and 114 in the Home School. Not included in this figure is Broward Junior College which is under the public school system and has an additional 2,450 students and growing.

While up until recently Broward County depended on tourist trade, the emphasis is swinging towards an emphasis on sophisticated industries, the greater portion being in electronics because of the relative short distance to Cape Kennedy. With all this in evidence, the need for a revitalized industrial arts program came about with full cooperation of all concerned. This included the county school administrator, principals, and teachers.

What then has taken place in the Broward County industrial arts program in the last three years to keep up with this community growth both in industry and population?

I had not previously mentioned that the county has been building two secondary schools per year. These plants are completely air conditioned including the industrial arts facilities. While in the previous years the facilities consisted of one drafting room and one woods lab, the new facilities include drafting, printing, metals, and power mechanics, soft material fabrication (woods), and the newest area—*electronics*.

In establishing any new programs, the greatest difficulty we find is getting the necessary qualified teacher. This we did by setting up an in-service training program using a teacher who had conducted the first pilot program in electronics. I might mention Warren G. Smith was our first instructor.

I believe the first year we had approximately 21 out of 48 teachers at the time who participated. I might say here he did not do this gratis as the salary was paid through the general adult education program. To make a long story short, we have 21 electronics programs in operation in the industrial arts program with two additional programs next year. (Many other things are taking place such as a special learner program which is being designated for next year.)

Rather than take any more time to explain our over-all program of industrial arts, I would now like to focus our attention on a new school (Nova High School) which is in its first year of operation. At the time of the school's inception, it was to be designed for a hard-core academic program. However, after a great deal of convincing, the director, Arthur B. Wolfe, became sold on the idea of a technical science program which would include home science, mechanics, technology, electronics, engineering drawing, graphics, and commercial art.

The background which leads up to the development of this school is as follows:

In March 1960, the Chairman of the Board of Public Instruction, Broward County, Florida, presented a proposal to the other board members that a large tract of land in the western area of Fort Lauderdale be secured and used for the development of an educational program for students in grades 1 through 14 plus a program of advanced university training.

This park would provide for experimentation in school construction, climate conditioning, year-round use of facilities, and for new programs in education. This proposal was discussed on many occasions, and from time to time revisions and additional concepts were added to the original proposal.

It was through the leadership of the Superintendent of Public Instruction, early in the year of 1961, that a series of firm proposals were agreed upon. These proposals were submitted to several nationally recognized leaders in the field of education. Without exception, the leaders endorsed these ideas and gave encouragement to the Superintendent and Board of Public Instruction to proceed with the Center.

In July of 1961, members of the staff were given the assignment of planning and activating a new educational facility to be known as the South Florida Education Center. The plan provides for a program of instruction from kindergarten through upper level university training.

Paul W. DeVore, *Director*
Division of Industrial Arts,
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TECHNOLOGY: A STRUCTURE FOR INDUSTRIAL ARTS CONTENT

In recent years, there has been considerable discussion by leaders in our profession about the concept of technology and the determination of a foundation for curriculum structure.

It would seem important then to review some of the basic concepts of technology and attempt to identify certain salient aspects which may be significant to the study of industrial arts.

To engage in this type of exploration requires that the profession accept the hat of the critic; not in the negative sense, but in the positive sense.

Today one discovers as he searches for the key ideas, concepts or significant issues of his profession, that the very environment clouds the scene. The speed and rapidity of change together with the expanded communications and knowledge of the universe is confusing.

To overcome this problem and to gain perspective presents a problem. One solution, which offers a means of obtaining a perspective, is the study of history.

From an historical review and reflection, it becomes clear that industrial arts, as a profession, has failed to implement a sound and basic philosophy. To date, the profession has been about two-thirds philosophy and one-third action.

One of the major needs is the identification of a strong central integrating purpose from which to derive a stable structure for industrial arts.

The second discovery is that the curriculum is out-of-date. This was easily accomplished and can be attributed to a failure to develop a curriculum structure which provides a foundation with external stability and internal flexibility and adaptability to technological change.

The third problem is the result of the first two. The efforts of the profession have failed to establish this area of education as an intellectual discipline.

Identifying the problem is the first step. The next is to search for a solution. Review and reflection are the basis for a possible solution. Reflection discloses that industrial arts, as an area of education, is closely allied with applied science and technology and derives subject matter content from the technologies.

This being the case, it may prove worthwhile to explore some of the ideas and concepts of technology. This can be done by relating what may be called the story seldom told, the story of technology.

An awareness develops that this story is about man and technology and his great intellectual achievements. A journey back to the dawn of civilization identifies these achievements. This journey shows that man, through his technological development, has created a vast storehouse of technology.

Man's five great intellectual triumphs were (1) the discovery of tools, (2) the discovery that one tool could be used to make another tool, (3) the cultivation of plants or agriculture, (4) the industrial revolution, and (5) the present industrial-scientific revolution.

In ancient civilizations, craftsmen at given times held key places in their societies. Evidence shows that many civilizations ceased to flourish and ultimately perished. There is evidence that this occurred soon after craftsmen were made the slaves of the ruling classes and their freedom was denied.

The ruling classes considered themselves to the the "intellectuals." As a result, discovery and invention ceased and the civilization collapsed.

Industrial arts is a field of education with a proud and humble heritage. It is a heritage with a distinct philosophy and certain practices.

This heritage can be traced to the very foundation of the industrial revolution. It is a foundation based on a reservoir of mechanical and technical achievements in the 12th, 13th, and 14th centuries.

These attainments together with happenings in the Renaissance and the industrial revolution provided the background for the development of educational theories concerning industrial arts.

The technology which man has created is unique because it has no boundaries. It is an intellectural discipline of international proportions. Science answers the question of what can be known. Technology answers the question of what use can be made of what is known.

Today technology is interdependent with science resulting in a universalism of industrial processes. Industry, through technology, has reached a stage of development where it shares like points of view, like disciplines, like reference to objectively valid criteria, and like modes of making judgments.

Technology seems to have reached the universality of science which is based on law, order, regularity, and patterns of interdependence in nature.

So universal has technology become and so great its growth that it affects all aspects of contemporary civilized existence.

In very recent times it has produced a series of revolutions. Several can be cited. One is a chemical revolution occurring in the very material foundations of industry.

A second great revolution has been accomplished in the areas of standards and specifications as criteria for selecting best methods, processes and products.

In addition, by combining the attainment of automation with the development of computers, man has brought forth a great revolution in the processing methods of industry. Cybernation is an accomplished fact.

World War II ushered in the fourth revolution with the advent of atomic energy. Systems of energy supply have been completely altered by this development. An entire new concept was born.

In addition, man has linked and unified his technology into a component whole bordering on almost total automation by developments in transportation and communication.

Because of these developments, man is challenged today by the sound of a different drummer. The challenge is that of technology, which like the freedom granted to us by our forefathers, must become everybody's business. Each and every citizen must attain the proper comprehension of the whole process of advancing technology, and understanding of our technical strength and the role each citizen must play in order to retain and advance our culture.

The call of the drummer for the profession is to establish a foundation, a common ground and a basis for action for the present and future.

The drummer calls with a mandate supported by an analysis of man's special power. The mandate challenges the profession to establish a new curriculum structure based on a strong central integrating purpose and one which exhibits the elements of external stability and internal flexibility.

The selection of a curriculum foundation should also provide a structure which provides for the tenets of an intellectual discipline.

This will mean the abandonment of many of the previous curricular approaches including trade and job analysis, occupational analysis, material oriented courses, manual training, manual skill, manual arts, home mechanics and handicrafts.

These approaches must be abandoned because they are narrowly conceived and restrictive of the true effort. They are incapable of flexibility.

The challenge to the profession is to educate the youth of our nation for a culture dominated by technology.

Acceptance of this challenge presents many problems. Cognizance must be taken of that fact that all of men's endeavors cannot become a part of the school curriculum and that no one activity can serve as a master activity in the school curriculum.

Major technical efforts identify man as a builder, a communicator, a producer, a developer, a transporter, and organizer and manager of work, and as a craftsman.

It is proposed that industrial arts, as a profession and discipline area, contribute to the study of man and his technology through the following organizational structure: (1) construction, (2) communication, (3) manufacturing, power and energy production, (4) research and development, (5) transportation, (6) management and organization, and (7) crafts and services.

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INDUSTRIAL ARTS AS A CULTURAL EXPERIENCE

THE development of this topic centers around three basic postulates regarding Industrial Arts as a cultural experience. The first is that a comprehensive and in-depth study of Industrial Arts is a cultural experience dealing with one of the most dominant factors in the contemporary society.

The second is that many of the basic elements of content for the study of Industrial Arts have persisted throughout the history of mankind as matters of vital importance and primary cultural focus in the evolving societies.

And last, there is an increasing void in the education of contemporary man with respect to his understanding of "industry and technology" as dominant cultural factors.

Industrial Arts leaders have for years attempted to develop a program of broad social significance. They have tried to establish a form of Industrial Arts that would attain a stature commensurate with the apparent richer values that lay hidden beneath the surface of job analyses, skills, operations, and things to make.

However, their efforts have centered chiefly in the areas of techniques and operating procedures with the depth and scope of social significance narrow and confining.

Industrial Arts has been defined as those phases of general education which deal with industry, its organization, materials, occupations, processes and products, and with the problems resulting from the industrial and technological nature of society.

Ashley Montagu has defined culture as "the way of life of a people. It is the people's ideas, sentiments, religion and secular beliefs, its language, tools, pots and pans, its institutions."

John F. Cuber in his text, *Sociology, Culture and Society* has presented a "sociological" meaning of culture that again reveals a strong inference for Industrial Arts. He also stresses the range of materials as well as the skills that man has developed and passed down through the years.

However, Industrial Arts is more than the study of materials. It is the study of industry and all its contributing parts.

Paul Meadows in *The Culture of Industrial Man* has stated that "Industrialism . . . is the primary characteristic of contemporary civilization." He has identified industrialism as the culture for a large and increasing number of people.

The study of tools has long been a vital part of the Industrial Arts program. However, this study is usually confined to a limited few of the contemporary items commonly found in the school laboratory. On the other hand some few teachers have attempted anthropological studies of tools with considerable success.

The importance of tools in the development of man extends into deeper implications than the means whereby man has been able to provide himself with food, clothing, shelter, and offensive and defensive weaponry.

Recent discoveries have tended to establish a new role that tools have played in the development of man and his physical makeup. Sherwood L. Washburn in his text, *Tools and Human Evolution,* shows that the various stages of man's development were dependent upon his success in using the simplest of tools.

Throughout the history of man there has been the ever-present influence of the element of tools, materials, processes, etc., as currently identified with the areas of Industrial Arts.

There is an obvious lack of understanding on the part of the educated as well as the uneducated along these lines. The literary nature of most historians has not prompted them to deal with the technological, productive, or material elements of the various periods of history.

I am certain that the Arnold Toynbees and the great historians of the 25th century will look back upon this period with amazement and wonder. I am confident they will immediately identify the industries and the materialism of this age as dominant characteristics.

This materialism is the result of a complex productive giant unequalled by previous man. But these future historians will be a bit amazed to find little or no instruction for the citizenry that would contribute to their understanding of it.

Aside from the gross indifference on the part of the industries and educational planners, there are numerous special problems that face man as he attempts to deal with such an instructional need.

Let us look into some of the factors that enter into the present difficulty. First, there is the expanding production in the world. The gross national product in the U. S. alone stands at 600 billions for a single year. This compared to a gross national product of 30 billions some 70 years ago.

This raises the question as to how one becomes informed about the processes and institutions involved. In past years it was possible for the boy or girl to watch the craftsman through his shop window as he made garments, shoes, hats, foods, wheels, wagons, forgings, books, newspapers, etc.

Today this sidewalk-show window has been replaced by huge walled fences and stark signs that say "Private Property—Keep Out" or "No Admittance—Apply at the Office."

Even those who do work in these highly specialized plants have very limited contact and involvement with the total process.

Thus there are two inhibiting factors at work. First, there is the tremendous range of materials and products, as well as producing units. Secondly, there is the separation of society from the producing elements. This condition will be further magnified as more and more mechanization and automation enter into the production processes.

There is another factor that has a marked effect on what one knows and understands about the productive processes and their products. As a specific example, there was a time when the processes involved in the use and making of things from wood were limited. The tools were simple. The uses of wood were common and obvious.

Today our forests provide us with more than 5,000 different products. The average individual uses untold numbers of products that originate from wood. These involve such things as acetic acid, baking yeast, carbonic acid, sugar, resins, animal food, industrial chemicals, stains, plastics, synthetic rubber, solvents, medicines, laminates, bleaching materials, papers, adhesives, etc. Yes, man uses such items, but does not understand their source or means of production.

The oil and coal industries have had similar histories of growth in products and use.

The American citizen is a consumer without equal. However, his knowledge about the materials he consumes and the processes by which such things are made is obviously scant. In many respects he is a stranger in an affluent society.

History has recorded numerous incidents where ignorance was a prime obstacle to the progress of industry or a materialism that was destined to be of value to mankind.

Industrial Arts can assume a major role as a subject of great cultural value if the profession chose to make it so. Prime responsibility rests with the leadership and the teachers of Industrial Arts to provide a system of education compatible with the cultural needs of an individual living in an industrial and technological age.

It is also important that the educational planners at all levels realize that this educational cultural gap exists and that it needs to be filled if the products of the school are to be truly effective individuals in a culture dominated by industrialism.

There can be no mistaking that the growth in gross national product in the U. S. has been a factor in our world leadership as well as contributing to our high standard of living. Furthermore, there can be no mistaking that man's progress throughout the ages has been geared to his ability to harness the forces of nature with the tools he has been able to fashion and improve.

But the strange paradox is that modern man in his system of education is inclined to neglect or ignore the factors that have added to his material and physical well-being.

Contemporary man will spend great fortunes and talent studying ancient civilizations to determine how such people lived, communicated, carried on their crafts, and tilled the soil. But it is a paradox that contemporary man knows little about the source and processing of his breakfast foods, the design and weave of his clothing, the simple electronics involved in his automobile, etc.

Major problems of manpower face this nation in the critical areas of trained technicians. The military services and numerous industries are currently finding themselves with complicated and perplexing equipment that challenge the finest minds to repair and keep operational.

Yet the dignity, prestige, and encouragement necessary to attract these people are lacking simply because a society of great technological accomplishments has seen fit to give second-class fare to the study of the products and producing elements of the society.

INDUSTRIAL ARTS—A VITAL PART OF EVERY STUDENT'S EDUCATION

JOHN J. GIOVANNONI, JR., *Supervisor*
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INDUSTRIAL ARTS IN KINDERGARTEN THROUGH GRADE 6

THE regular classroom teacher has the responsibility for conducting the elementary school industrial arts program. In some school districts in certain states, industrial arts courses provided in grades five and six are taught by teachers with special preparation in the field of industrial arts and in specially designed and equipped facilities.

Youngsters progressing from kindergarten through grade six must have basic understanding and appreciation of the industrial technology and culture of America. It also provides the creative and purposeful opportunity for children to express their ideas and feelings.

This important ingredient of the program can continue and improve by having well-trained teachers, providing adequate facilities and material and by offering a purposeful industrial arts program from kindergarten through grade six.

The program must also maintain a strong supervisory staff, keep parents and community informed of the values and by integrating subjects. It must offer an in-service training for teachers and schedule television programs for staff and children.

Fred A. Baer, *Supervisor
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INDUSTRIAL ARTS IN GRADES 7-8 AND 7-9

In grades seven and eight of elementary schools and grades seven, eight, and nine of junior high schools, the industrial arts program is an integral and often required part of the total program of education for all youth.

The purposes of industrial arts at the junior high school level are to develop in each student, an insight and understanding of industry and its place in society, to discover and develop student talents in industrial-technical fields, to develop problem-sharing abilities related to the materials, processes and products of industry, and to develop skill in using tools and machines proficiently and safely.

The typical industrial arts programs include a broad selection of offerings. In grades 7, 8, and 9, drafting, electronics, graphic arts, industrial crafts, metals, power mechanics, and woods are offered as introductory courses.

They offer exploratory experiences to 7th- and 8th-grade students, either through a sequence of 10-week courses with students rotating through four shops in the 7th grade and two more in the first half of the 8th-grade in large schools, or smaller schools may offer the same subjects in various combinations in a general shop under the direction of one teacher.

The areas of drafting, electronics, metals, and woods are usually required of all students.

In recent years there has been increased occupational guidance at the junior high school. The relationship of industrial arts to other subjects has been given additional emphasis.

Changes in curriculum are evolving from current practices as creative teachers try out new ideas. The teaching of power mechanics is not new, but many school districts are taking another look at including "powers" in the junior high schools. This area includes the one cylinder two-cycle and four-cycle gasoline engine and new areas of power, such as fuel cells, jet engines, and other exotic forms of power and their application.

There is increased interest in the "Research and Development" approach to industrial arts. Some schools report special classes for "academic" or "junior engineers" to develop projects and problems through industrial arts. These are restricted electives for bright students to research, plan, and develop problems relating to science and technology.

Another trend, which is not new, is that more girls are enrolling in industrial arts courses in drafting, electronics, and graphic arts as an elective in the 9th grade. Girls are succeeding in these courses with little modification of content.

Many principals are convinced that the industrial arts program in junior high school has value to all of the students enrolled in the school.

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INDUSTRIAL ARTS IN GRADES 9-12 AND 10-12

IN grades nine through twelve and ten through twelve, the industrial arts program provides opportunity for the high school student, regardless of his major, to choose the industrial arts courses he believes will be of the greatest value to him in attaining the goal he is seeking. Included in the program are elective courses which provide instruction in the broad areas of automotive mechanics, drafting, electronics, graphic arts, industrial crafts, metals, power mechanics, and woods.

These courses are taught by teachers with special preparation in the field of industrial arts and in specially designed and equipped facilities. The advanced techniques developed in these courses approach the procedures used in industry. At this level emphasis is given to occupational practices and information relating to each industrial arts area and sub-area.

The variety of courses provided in a high school depends upon the staff, the facilities, and the needs of the students and the community. In high school, the work becomes increasingly specific and in certain instances borders on specialization depending upon the ability and interest of the students.

The major purposes of industrial arts that should be further developed are an insight and understanding of industry and its place in our society, talent in industrial-technical fields, problem-solving ability related to the materials, processes, and products of industry and skills in using tools and machines proficiently and safely.

Some promising practices of industrial arts are accelerated courses for the more able. These sometimes carry the prefix of pre-engineering in the areas of metals, electronics, drafting, and others.

Pre-technician or junior college programs are showing promise. In general, the practice has been to utilize a team of four subject area teachers who relate well to high school age students and who are capable in their fields of mathematics, science, language arts, and industrial arts. In this program, the subject matter learned in one class is applied in others.

The introduction, study, and testing of new industrial materials is being included in many industrial arts classes. The amount depends upon the ability and interests of the students.

It is important that flexibility is maintained in industrial arts programs so that a program can be adapted to the student instead of the student to the program.

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INDUSTRIAL ARTS AND THE JUNIOR COLLEGE PROGRAM

MANY junior colleges, community colleges, and technical institutes provide programs that build upon the industrial-technical knowledge and skills acquired by the students in the industrial arts courses in grades seven through twelve. In particular, these two-year institutions provide foundation courses for the industrial arts teacher education and industrial technology programs of the colleges and universities.

Usually the content of foundation courses for future industrial arts teachers is developed in cooperation with the industrial arts department of the college or university in the service area so that students can transfer without loss of unit credits. The courses are three semester hours each in automotive mechanics, drafting, electronics, metals, and woods.

In addition, the two-year institutions find that high school graduates with a background in industrial arts meet with success in industrial-technical, technical-engineering, engineering, and applied science curriculums.

Many junior college department representatives maintain close liasion with the industrial arts teachers in the high schools in their service area through visitations to the high schools, distribution of literature, and meetings with individuals and groups.

Representatives of junior colleges also maintain close liaison with industrial arts departments of colleges and universities by serving on department advisory committees.

HORACE O. SCHORLING, *Professor*
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INDUSTRIAL ARTS AND THE COLLEGE-UNIVERSITY PROGRAM

THE industrial arts program in institutions of higher learning are broad in scope and generally characterized by the following: (1) industrial arts teacher education, (2) education for industry and business; (3) cooperation with other departments in the preparation of their majors, and (4) services to the general student, the public, and the profession.

In California, the new certification requirements for industrial arts teachers includes a baccalaureate degree plus a graduate year.

The program includes fifteen semester hours of foundation lecture-laboratory technical courses covering a minimum of five areas, twenty-five semester hours of lecture-laboratory technical courses, five semester hours of course work covering philosophy and history, organization and management, safety, and curriculum, six semester hours of graduate technical courses, and six semester hours of student teaching.

General trends include higher entrance requirements, a common core of liberal arts, greater emphasis on technology, greater emphasis on related instruction in mathematics, science, art, and the behavioral sciences, expanded programs in research and development, mass production and automation, creative problem solving, and product design and development, and great specialization.

Robert L. Woodward, *Consultant*
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SUMMARY

EACH member of the team concisely described a part of the total program of industrial arts education which extends from the kindergarten through the colleges and universities.

Among the ideas and promising practices covered in the presentations were an introduction of succinct titles for areas of industrial arts to be provided in grades seven through twelve. This reduces the confusion of terminology for students, parents, and educators.

An explanation of more meaningful curriculum in secondary schools was given which provides courses with evident relationships.

A recommendation was made that there be at least two articulated courses in an area or in the combination of two or more areas at the high school level.

The relationship of the industrial arts program in elementary schools and high schools was shown to further education and training in college and university, junior college, and government and industry.

The recommendation was made that two-year institutions provide specific foundation courses for college and university industrial arts teacher education programs.

Robin Kazer, *Assistant Director*
and
Ronald Huebner, *Supervisor of Industrial Arts*
New York City Schools

Science and Industrial Arts

"WHEN looms weave by themselves, man's slavery will end," wrote Aristotle more than 2,000 years ago. Today his looms weave by themselves and other machines cut, polish, assemble and package themselves. These machines are becoming more and more automatic and depend on his menial tasks less and less. This is automation—a new era of technology.

The changes which have taken place the past five years are greater and more dynamic than for any other period following the Industrial Revolution.

Why have these changes occurred so rapidly? Thorstein Veblen has said, "Invention is the mother of necessity," and perhaps we don't agree with this inversion of a familiar phrase. However, there is no disagreement in the knowledge that these revolutionary changes were brought about by research and the cooperative and creative efforts of scientists, mathematicians, and industrialists. They were not accomplished by isolated individuals working in a vacuum.

Now let us examine the average industrial arts program. We find the loom operated by hand. The program functioning in an intellectual vacuum. The other curriculum areas are ignored. If the other areas are involved it is only an "incidental or accidental" manner.

Unfortunately few industrial arts teachers have made a planned and concerted effort to integrate their work honestly with the curricula or services of the science and mathematics departments.

It is our purpose to discuss some of the integrated activities of industrial arts teachers in New York City, so we can share their ideas, approaches, and problems.

We have three high schools in our city which cater to the intellectually gifted. These students are accepted on the basis of a competitive examination. At these schools the emphasis is on math and science. All students are required to take industrial arts.

At the Bronx High School of Science, as part of the industrial arts program, the students are required to build projects related to science or math, or illustrate basic principles of science. These projects are selected and developed by the pupils with the guidance and assistance of the teachers in math, science, and industrial arts. Many of these projects, such as digital computers have been entered in science fairs.

At Stuyvesant High School several students in the industrial arts shops, with the assistance of the physics department, built a cyclotron.

Another class has built telescopes and as part of the course they constructed a Foucault tester to check the curvature of the mirrors they were grinding. In their ceramics course, the youngsters were required to grind their own glazes, prepare an experimental glaze, and build a project related to science.

For example, they were encouraged to do scientific sculpturing. These models were used as teaching aids by their physics and biology teachers and were checked by them for accuracy.

At several other academic high schools, classes of bright pupils were programed for industrial arts as well as biology, chemistry or physics. The teachers of these industrial arts classes worked with their colleagues in the science department so that the work and projects were related to these areas. It is interesting to note that most of the winners in the science fairs and Westinghouse Scholarship awards at Jamaica High School were students in this special industrial arts program.

Some of you may claim that I am describing a program for the bright pupils, and you wish you had them. "Only the 'dregs' are assigned to our shops." Sometimes I wonder whether the administrators feel that is all we deserve!

At another high school, where only these low achievers are assigned to industrial arts, an attempt is being made to influence the administration. This past term a program of team teaching was initiated which involved one science teacher and one industrial arts teacher.

As a beginning, only a half dozen lessons or sessions have been planned. For example, following a study of steel in the science class, the students observed demonstrations of case hardening and tempering in the industrial arts shop. This initial phase of team teaching appears to be meeting with success at this school.

As a result of pre-planning and the proper selection of teachers the students appear to have a better understanding of a motivation for these two areas of the curriculum. It is hoped that this program will be extended to include the academic students who are now deprived of industrial arts.

In the junior high schools a different approach from the high schools was used. A city-wide attempt was made to coordinate the activities among key personnel. This was accomplished by the director of industrial arts, Herbert Siegel, and the assistant director of science preparing a list of schools and the recommended teachers of science and industrial arts for this program.

These teachers and their assistant principals were invited to a meeting where the director and assistant director of these areas explained a need for developing a program of integration. It was felt that the weaknesses in the industrial arts program, which is rich in manipulative skills but weak in scientific instruction, and the lack of laboratory experiences in the science curriculum, might well be alleviated through combined effort. By substituting projects related to the areas of endeavor in the science program the projects might become more meaningful to the pupil and also correlate the two fields of endeavor.

In this program the classes were assigned to the science teacher as well as the industrial arts teacher for one term. Classes reported to the shop two double periods a week. Early in the school term basic projects, such as a sundial or maze were utilized as a means of acquainting the pupils with tools and materials and to orient them to their science curriculum.

As these were completed the students developed individual and group projects such as mercury thermometers, seismograph, Foucault pendulum, etc.

There are many values that may be accrued to this program:

1. Many scientific concepts are reinforced.
2. Students become familiar with the practical aspects of their experiments.
3. Students have an opportunity to apply the scientific method to their research in the shop.
4. Science projects become more creative and attractive.
5. Pupils are motivated to explore the possibility of careers in the scientific and technical fields.
6. Greater respect and prestige for the science and industrial arts departments.
7. The students become aware of the interdependence and contributions of science and industry.

However, "not all that glitters is gold," neither were all attempts at integration successful. In evaluating our successes and failures, the following suggestions are offered:

1. Initiate the program on a small scale. This will make it feasible for the supervisor to devote his time to guide and encourage his teachers.
2. Coordinate the selection of the teaching team. The teachers must be interested in the program and have the intellectual curiosity to motivate their students. It is essential that these teachers have the ability to get along with one another.
3. A realistic agreement on the part of the team teachers as to type of project to be constructed will avoid frustration and discouragement of

the pupil. A resource file should be developed to motivate the pupils.

4. Gear the program to the ability level of the pupils. If you have the bright, academic youngster, challenge him. If you are teaching the non-academic student, don't lose him by getting too technical.
5. To be totally successful the two or three areas must be planned together and the teachers must have common preparation periods to discuss progress and direction.

Do we have the answer? I am not sure. But I do think this is an attempt that merits nurturing and consideration.

ALAN P. KEENY
Montgomery Hills Junior High School
Silver Spring, Maryland

THE INDUSTRIAL ARTS RESEARCH LABORATORY

THE Industrial Arts Research Laboratory at Montgomery Hills Junior High is the result of cooperation between the University of Maryland and the Montgomery County, Maryland, school system. Dr. Donald Maley, Head of the Industrial Education department at the University of Maryland, presented the idea to the county six years ago. The first program was begun at the Montgomery Hills Junior High school.

The program is now offered in three junior highs. One senior high is offering a teacher recruitment program using the research approach as part of the program. One senior high had a very successful program until the instructor transferred.

It appears it will be included in the new schools and offered in the high schools as the students from the junior highs begin to request it.

The program can be simply stated.

It is a program based on contemporary society and upon the needs, interests, and motivations of the future engineers, scientists, researchers, analysts, and similar persons. Its success lies in the curiosity of the individual.

The program makes available industrial arts tools, equipment, and materials with which the student can test and evaluate products, processes and materials, applying scientific theories and procedures.

In this laboratory experience the student selects a problem of interest to himself that can be solved through experimentation. He then outlines the problem and proceeds to determine the necessary approach to obtain valid results and the necessary apparatus to perform his test.

Research into the areas of science involved are a part of the expected procedure. The date is checked and conclusions are formed. The final results are put in proper written form and orally presented in a formal seminar.

There is no course of study or course outline as such in which it is stated the first week we teach wood joints, the second, electronics, etc. It is based upon the individual needs, problems and advancement of each individual in the class.

It is obvious the industrial arts research laboratory is not recommended for all students. It is for those individuals who are somewhat gifted, who are intellectually curious and who have generally gone beyond the offerings of a general industrial arts program.

Almost all students will have had the general industrial arts in the seventh and eighth grades.

One of the laboratory's guiding principles is the development of people rather than things. A student soon learns his strengths as well as his weaknesses in a program in which he has selected his problem, solved it, and then justified his work before a group of serious-minded peers in a seminar.

The seminar's purpose is to develop critical and analytical thinking as well as the sharing of information.

What are we accomplishing in this type of program? I feel we are accomplishing five things—the satisfying of needs and curiosity, developing self-reliance, thinking and problem solving. In other words, the students have taken a step toward maturity.

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Department of Industrial Arts
Shaw High School
East Cleveland, Ohio

and

Ronald D. Todd, *Instructor*
Graphic Arts and Drawing
Wickliffe High School
Wickliffe, Ohio

RESEARCH AND DEVELOPMENT AND YOU

We would like to present our views on an area new to industrial arts, that is not only experimental in nature, but experimental in concept. The area, research and development, is not by any means our product. We would like to share with you some insights and possibilities we have come to recognize in this field.

Of all the new areas and activities now being considered for industrial arts, research and development might be considered an intruder.

We find little in the past of industrial arts to which research and development can be related. Acceptance of this new area may indicate the totally new nature that industrial arts is assuming.

There has been a breakthrough in education that is having vast repercussions that we all are feeling. Trump and Baynham stated in their *Guide to Better Schools* that the American secondary schools need to focus on change for added quality. The acceptance of this idea is brought home quickly when one surveys the many different studies that have been initiated in the past few years.

One important area, that of industrial arts, seems to be missing from the list.

The authors would like to propose that research and development serve as a method for upgrading existing programs in industrial arts. A large scale experimentation and research program with a workable system of communications must be implemented.

Some of the primary concerns in a program such as research and development deals with the methods used to bring about individual student involvement.

How can students be instilled with a sense of power and accomplishment? How can a high level of student interest be brought about and maintained?

Many of the vehicles now used in the teaching of industrial arts can be applied to the teaching of research and development. Industrial trips, films resource people, discussions, lectures, and demonstrations all have their places. Brainstorming, idea tracking, and experimenting may also be used.

What about placing the student in the role of a researcher or developer?

Such leading educators as Brunner, Foshay, and Phenix have advocated the study of a discipline or technology directly by the student. If a student studies history, he should study it as a historian would. This requires the student to take on a new role—not one of a receiver of information, but one of a producer of information.

If industrial arts can claim the technologies as its domain, a completely new organization is required. For a technology is, as a discipline is, a conceptual structure and requires a study of its concepts and their relationships. It will require both student and teacher to become aware of and function within the technologies. Research and development can help accomplish this.

How can research and development help the teacher and student function with the technologies? For a working definition of technology we will call them living and expanding bodies of knowledge and skills.

Research and development contributes to the extention and growth of the technologies. If it is to allow the teacher and student to study and expand the technologies, it will have to be through a conceptual structure which must be identified.

This structure, which is called a fundamental structure, if it is conceptual in nature, would have significant implications not only for industrial arts, but for all areas that are researching in nature.

Research and development provide the method of study on the frontiers of new knowledge and new skills within a technology.

The cry for many years has been that industrial arts activities are behind the times. Research and development can shorten that gap.

We may view research and development as it relates to a curriculum that is composed of contemporary subjects based in the technologies and devised to allow students to study the technologies directly.

One program is developing at Shaw High School in East Cleveland. Courses in manufacturing, power technology, electronics, construction and graphic communications have replaced the traditional courses during the last few years. In this program research and development serve as the integrator of the program.

The boundaries of research and development can be established or dissolved by our third factor, You. Instructors, supervisors, administrators, and educators alone can accept the challenge.

Karl Gettle, *NDEA Fellow*
University of Maryland
College Park, Maryland

THE GROUP PROJECT: AN OLD NAME–A NEW VENTURE

THE idea of the group project is not a new one. It has been with us, ever since the time of Neolithic man, when several men would unite their individual skills in an effort to solve their problems, such as obtaining food or defending themselves.

The idea of the group project has been carried on ever since, though it has been only since the time of Kilpatrick, or more recently the group dynamicists, that this method and its terminology, group project, group process, etc., has received the attention of educators.

Before I go any further, I better describe my view of the group project and its advantages. To me the group project is face-to-face interaction by two or more individuals in which there is a problem-solving and co-operative functioning involving these persons.

It is the means by which the resources of several individuals are united into a pattern of pursuit on a common problem through effective action directed at solving the problem at hand. This action may result in a scale model of some industry, such as a working model, similar to the 1903 "Delton" auto built by the Westfield Senior High School in New Jersey, a set of drafting plates, or any other adventure in which there is a cooperative effort involved. The project itself is not the important element in this process. To me the most important aspect of the group project is the development of the individuals concerned.

The advantage of the group project is that it affords the opportunity to develop individuals to their maximum while, at the same time, permitting a study in depth of the processes, problems, products, and organization of industry.

First, permit me to discuss the aspects of developing individual differences. In the group project, the achievement standards for each pupil are ascribed to the individual rather than to a grade level. In this type of situation each student works to his capacity and the goal of the teacher is that of creating educational experiences to insure optimum development of each individual.

The goal then is to develop individuals and not to have all students follow a fixed pattern which often has an unrealistic educational base. In fact individual differences are encouraged since it is through our differences that we become better contributors and learners.

In the group project there is no place for the popular folk song "Little Boxes." You are probably familiar with the lyrics which claim that after all of lifes' experiences, such as going to school, etc., we "all come out the same."

Another quality of the group project is the depth to which the students go in learning about the topic at hand. The degree and rate of learning is greater in the group project than what it is for the individual project.

In all of the group projects with which I have been associated, I have found this to be true. Rarely have I seen a class of students go to the depth of study of an industry as what I have in the group project.

Thus far I have said nothing as to the steps one should follow in carrying out a group project. My reason for this is that when a "method" is suggested it often is followed like following a recipe in a cookbook—and where step-by-step directions are needed to assure a perfect cake every time, a "cookbook approach" to teaching can be futile and even harmful if the teacher does not have some of the basic understandings about the aspects that I have tried to discuss.

Therefore, instead of giving you a step-by-step procedure on the group project, I will attempt to outline some of the elements involved in the group project.

The first element in the development of the group project is that the teacher must be competent and have a firm conviction as to the value of the group project. For like other educational innovations in the field of Industrial Arts, the group project has been scoffed at and laughed about.

It has been described as a gimmick to help the incompetent teacher over situations in which he is "short" of instructional know-how. Many have described it as a profitless and time-wasting method of education. However, if we look at the research we will find the group project method of instruction has real value in the school program and that it is not a cover-up for any lack of preparation on part of the teacher.

In fact the group project requires a more competent teacher than some of the other methods such as those in which the primary purpose of Industrial Arts is regarded as the mastery of the knowledge and skills of tools and materials, and where a dictorial philosophy of education is held by the teacher.

In this case, the teacher has a relatively simple job. He has only to organize his material and then proceed to cover a certain amount of content each week. On the other hand, when learning is regarded as the modification of behavior, and a democratic philosophy of education is held so that optimum learning for each individual child can take place; the teacher and students are faced with the difficult and crucial question—How can we best organize this group to achieve our goals?

The group project therefore is not for the incompetent teacher but rather it is a method which requires a highly sensitive and competent teacher. The group project requires a teacher that is a jack-of-all trades (and master-of-all, too), in such areas as realizing the needs and capabilities of each student; the technique of group processes; the biological, psychological, and sociological aspects of learning; tool skills; and content material in the many facets of industry.

Another significant element of the group project is the atmosphere in which the group works. Members of a group tend to work cooperatively, constructively, and productively when the atmosphere is cooperative in nature. A spirited, spontaneous, and relaxed participation on part of the group members results when there is a genuine understanding shown for each individual of the group. A radish seed germinates quickly in most any soil and climate; however, orchid seeds can grow only when soil, light, and moisture are exactly right for them. As the farmer, we will reap as we plant and nurture.

If the work on the group project is to be productive, then the affairs of the group must be well organized. It is only through well-organized procedures that the energy of the group can be harnessed and used most effectively.

The method I recommend to achieve this organization is the establishment of a personnel system. This is not to be mistaken as the typical clean-up personnel system, but rather it is a system based on the framework of the industry which is being studied.

You will find that the system is based on industrial methods in which such titles as project director, educational director, research director, public relations director, safety director, construction engineer, planning director, procurement director, and other similar titles are used.

Once the teacher is sold on the idea of the group project, his first step is to introduce the class to the group project by arousing their interest and inquisitiveness about some problem that might become the goal of the groups. Once the interest of the students is aroused, there should be a pupil-teacher planning session in which some criteria for selecting an appropriate project are established.

As I have mentioned, the group project idea is not new, nor is it one that can stand alone without the help of other methods of instruction. After many years of experimenting in our elementary schools with phonics versus sight reading and going through periods of using one way to the total exclusion of the other we are finally realizing that one can and must supplement the other.

So the group project method of teaching Industrial Arts is supplementary and supportive to these other methods and when used well, it is a process that enables the student to better understand and to receive fuller insight into all facets of industry as they influence the society in which he lives, as well as, providing for the development of people, which to me is our most important task.

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University of Maryland
College Park, Maryland

THE MASS PRODUCTION EXPERIENCE

MASS production is essentially the manufacture of a large number of products through the use of interchangeable parts assembled with specialized labor.

In order to gain insight into the nature of mass production, the class participating in the study must be organized according to the procedures utilized by industry.

To accomplish this, the students will engage in a study of industrial organization through an examination of literature, correspondence with manufacturing concerns, or visiting industries utilizing mass production procedures.

The organization of personnel in the class provides the students with opportunities for occupational role playing. The purpose and function of each student must correspond to a counterpart in a typical personnel organization of industry.

The personnel organization of the class also becomes the basis for studying the nature of mass production to greater depth. An educational director is an important member of the class studying mass production. The student selected for this position is responsible for determining and assigning reports concerning mass production.

The manufacturing period of mass production in the laboratory provides students with experience that leads to understanding procurement, use of materials, and processes and production.

Materials must be obtained by a procurement director and routed to the proper place on the production line. As raw materials are transformed into finished products, the students gain an understanding of the physical characteristics of materials through direct manipulation and observation.

In summary, I have attempted to present a rationale for studying mass production based upon two assumptions. First, the purpose of the study is to provide students with knowledge about an important characteristic of American culture.

The second assumption is that the nature of mass production is best learned through experience with tools, materials, and techniques.

George R. Horton, *Director*
of Industrial Arts
Urbana City Schools, Urbana, Ohio

EMERGING GRAPHIC ARTS CONTENT AND APPROACHES FOR THE INTERMEDIATE LEVEL

We sometimes hear the question, "Is content determined by activities, or is the reverse of this true?" I submit that content should be dictated by the economy, that is, the nature of the graphic arts industry. Of course, local industry may influence the emphasis that you will give certain phases, but with the more mobile and flexible work-force demanded in the future, and the role that our students will adopt as consumers, it seems that the course content should be oriented to the industry as a whole rather than to our immediate surroundings.

If you are involved with doing job printing for your institution, and many of us are, a majority of the projects and activities are predetermined or controlled by someone other than the teacher. This is not always the case. However, we as teachers have an obligation first to the student, and second to the school as a system. We must not neglect to give the student a perspective of the industry, a preview of opportunities, and an appreciation of what he is accomplishing.

When we go back to our respective schools, most of us will be faced with printing deadlines, jobs to run, quality and production standards to be met, in addition to the task of educating the students. True, we use production as one of our effective methods, but unless we are aware of the total course content as suggested by the national economy, we will be giving our students an education that is incomplete, distorted, and lacking in perspective.

It takes an alert and informed teacher to provide time for related instruction. In recent years we have been fortunate to have increasing amounts of information concerning graphic arts through publishing companies, through the efforts of our professional organizations, and from the industry itself.

However, the cry, "Give us time to teach," can be heard echoing through the corridors. We must make time and take the time to teach. This is an ever present challenge.

It is a relatively easy job to teach letterpress printing, for example, when you have the necessary equipment. If the department in your school does all of its work by offset, does this relieve you of the responsibility to teach something about letterpress and its changing relationship to the graphic arts industry? I think not! Rather, here is the challenge to explore other methods for teaching. Movies, industrial speakers, trips, . . . you know them as well as I . . . but, do you use them for the purpose of supplementing an already unbalanced program, or do you use these methods to complement your program and bring it into better perspective?

Two "approaches" that I find most effective with the high-school age youngsters are responsibility and research. Responsibility is one of the most sought for qualities by an employer. The assigning and rotating of meaningful responsibilities is of prime importance in achieving this quality. From the first contact with a customer (which in our case at home is always school personnel), to the packaging, delivery, and billing—the students should carry the load.

In research we attempt to instill the quest for perfection and knowledge in our students. Research is a word we want them to understand and respect long before they reach college, which is the place some of us were first exposed to it. Students can participate in their own research projects whether in a laboratory type experiment or a written report covering a phase of graphic arts not feasible by another method. Respect for research can also be enhanced by undertaking a field trip to a research center or the research division of a large industry.

For content, look to the industry, to the economy. Then attempt to balance your course and give it perspective, using the most effective methods available for the job.

Remember that your first obligation is to the student, not the school as a system.

For approach, at the high school level, we must maintain a scholarly and mature approach. The students should assume responsibility and learn to respect research.

Carl Brenner, *Grapic Arts Instructor*
Lefferts Junior High School
Brooklyn, N.Y.

EXPLORATION AND EXPERIMENTATION IN GRAPHIC ARTS

IF we are to work on the assumption that school is to serve as a laboratory for learning, then there is no area that has more meaning for the adolescent than the industrial arts. To help the pupils in achieving a successful realistic adjustment, the Industrial Arts provides our Junior High school population with a rich and varied program, geared in the direction of maximum exploratory experiences. To achieve a new self-image and develop one's own true potential, to appreciate scientific industrial processes, to explore our contemporary industrial civilization and to provide a healthful classroom climate in which to develop talents and interests, are inherent objectives of our program.

It is in a series of Graphic Arts units dealing with lithography, bookbinding, silk-screen printing, and composing room operations that our pupils are exposed to the wonders of the technical environment in which we have found ourselves for the past five decades. The pupil comes in contact with a variety of industrial processes through a series of sequential lessons and culminating activities.

Instruction is geared stressing research projects involving the use of audio-visual materials, realia, and trips to neighboring industrial plants. Pupils develop an appreciation of the role modern science has in industry, and this serves to encourage explorations and experimentation. Avocational interests are discovered and developed; leisure-time activities stimulated.

Opportunities for exploring talents, skills, personal interests and originality are available by doing a dry-point engraving, cutting out a linoleum block, thermographing a printed job, making and marbelizing paper, and completing a personalized rubber stamp. All boys from various classes and ethnic backgrounds learn to work together and develop an appreciation of the contributions each member of the team is able to make. Each pupil gains a new sense of his own worth, as his project grows. It is this new self-image that encourages our adolescent boys to further explanation of their own talents and interests.

To this already rich and varied program, through the efforts of the Industrial Arts department, directed by Herbert Siegel, the American Type Founders offset press, the Nashua metal platemaker and an Underwood electric typewriter were added. After a series of briefing sessions, with the Graphic Arts teacher, the industrial arts supervisor assigned to our district, and a group of selected students undertook the task of incorporating the use of this machine into the graphic arts program. Both students and teacher planned the activities for the many sessions to follow.

It proved to be an invaluable aid in providing a variety of additional exploratory experiences for our pupils. The advances made in science were obvious. The offset process was able to be seen by all the pupils. Scientific principles involved in Alois Senefelder's theory were explored in terms of the development of modern machinery used in offset printing. Pupils have been able to develop a realistic appreciation of the important scientific advances made in the industrial growth of our country. They noted the marked increase in speed of production; the breadth of creativity that is permitted in the preparation of original plates; the advantages that the "Chief 15" has over the Platen press; and the speed with which metal plate could be prepared.

Whole new areas are open for our pupils to explore. Artistic talents and interests are encouraged. Pupils are able to conceive and carry out their own ideas by being involved in all the processes included in the making of greeting cards, announcements, and novelties. All pupils are permitted to handle, operate and manipulate tools, materials, and other media that they had never been exposed to before.

Because of the variety of operations involved, it is expedient to organize the shops into teams, each responsible for his own specific operation. In this way, pupils learn to work closely together, dependent not only upon their own team members, but also upon all others involved in the final culminating activity. Pupils gain a new sense of their own importance on a professional basis.

We can see that continued research and experimentation not only play an important part in the Industrial development of America, but are vital aspects of our Industrial Arts program. Pupils are encouraged to continue their exploratory activities in Graphic Arts because they are constantly being exposed to new processes and machines. The Graphic Arts program is intimately related to the current industrial scene. Supervisors, always on the alert to new developments, provide the stimulation and resources through which the classroom becomes a live laboratory for experimentation and exploration. It is in such a climate that our pupils are continually exposed to the new, the experimental and the challenging. It is in this way, that vocational, personal and academic exploration can fully be achieved.

Robert H. Hawlk, *Associate Professor*
of Ceramics
Ohio University
Athens, Ohio

CERAMICS IN TOMORROW'S INDUSTRIAL ARTS PROGRAM: CERAMICS or POT MAKING

A traditional approach to teaching ceramics places emphasis upon the use of clay for making objects. The novice starts by making a pinch pot and finishes his bout with ceramics by demonstrating proficiency with the potter's wheel.

Between these extremes are many steps in the struggle to understand the nature of the raw material, clay, and learn the best methods for hand building increasingly difficult objects. At various times during his experiences, with this limited approach to ceramics, a student learns about glazes, firing techniques, and some consumer knowledge regarding the purchase of tableware.

In general, the student learns how to cope with the clay and gains some appreciation for artistic ceramic products. It may not be said that working with clay is easy if standards are observed.

Those people concerned with the ceramics industry find the word "ceramics" generally misunderstood. To the layman "ceramics" may mean pottery making by hand methods. Making ceramics is associated with avocational pursuits that are necessary in balancing some aspects of modern living. This activity is associated with elementary school or evening classes for adults.

Ceramics that finds depth in the study of modern industry is much more than just "pot making." Here lies a challenge for the industrial arts teacher to make of his courses in ceramics a basis for understanding and appreciating the breadth of modern ceramic industries.

Some representative ceramic industries are white wares, art ware, dental porcelain, structural clay products, glass, ceramic abrasives, cermets, ceramics for electrical and electronic uses, and refractories. These are but a small number of the representative industries from which an industrial arts teacher may secure content for a ceramics course.

With time a limiting factor, the problem of the ceramics teacher is to determine what is important to the particular group of students for whom he must prepare the course.

The professional ceramics teacher will answer this problem by investigating the real reason why each person is taking the ceramics course. After this has been determined, a common starting place is established from which divergent course work will evolve as the teacher learns to know each student.

For instance, an evening ceramics course for people in middle life would evolve about a need for a creative experience making objects of clay that could be displayed in the home.

For students of industrial technology the emphasis of the course might be on the development of production methods for ceramic products.

For a pre-dental college student the course might include many uses of the hands and fingers in learning to "see" with the sense of touch.

For architectural students the study of forms that relate to each other in design could be the nucleus for the course related to an understanding of structural ceramics and decoration.

Secondary students, who enjoy experimentation, may find their approach to ceramics could be adapted from the use of clay to express ideas much as the industrial designers model clay mock-ups of new products. This could lead to a further course in inventing where function and form are welded together in the same idea.

Another approach to industrial ceramics is demonstrated by dry pressing of ceramic abrasives. This can be done with presses adapted for this use that are usually found in industrial arts laboratories. Heats developed by kilns presently being used are sufficient to produce abrasives. It may be interesting to determine how much chemistry has been indirectly learned by the students who pursue this avenue to an understanding of industrial ceramics.

The first challenge for the industrial arts teacher, who develops a ceramics area, lies in his pursuit of the learnings that may be derived from a study of the ceramic industries. A larger challenge lies in his professional ability to select wisely and adapt these learnings for the benefit of his individual students.

WILLIAM W. ROGERS, *Chairman*
Mechanical Technology
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New Horizons In Plastics

THE growth of plastics, a man-created engineering material, is among the great phenomena of the twentieth century. This year we will produce about nine billion pounds of plastic. This will occupy about 160 million cubic feet. Were this made into plastic bags which could completely cover the earth's surface, we could make ten of them, each as thick as a human hair (two and half thousandths).

Plastics, as you may already be aware, started with the invention of celluloid by John Wesley Hyatt in 1868, and bakelite by Dr. Leo Henrik Baekelund in 1909. The former was the first thermoplastic; the latter, the first thermoset.

Coming more up-to-date, to the motor car, we now have a wide variety of thermoplastics, injection molded as instrument housings of acetal, and fiberglass reinforced car bodies of the Studebaker Avanti. They are on the waterboats with fiberglass reinforced hulls and decks, with foamed-in-place bulkheads to stiffen the structure and make them buoyant even though completely water-filled.

Industrially, their dielectric strength corrosion resistance, ease-of-molding, low-moisture absorption, high-impact strength make them desirable for drill motor cases, gears, couplings, cams, bellows, shock absorber mounts, pump housings, and impellers to name a few applications.

The ease with which plastic will flow in a mold, retain its color, remain inert to a wise variety of solvents and chemicals has made blow-molding of bottles, for example, a major industrial business. Some of these same plastics are used in food industries to cover fresh vegetables, bread and baked goods, retaining moisture and flavor.

Many dramatic break-throughs have been made in medicine, from substitute windpipes, heart-valves, to disposable oxygenerators. Silicone tubing, used in artificial kidneys, cuts down foaming of pumped blood. Other dramatic uses are being found daily—opening up a whole new medical-engineering-plastic science field.

Probably the greatest boost in adoption of plastics came early in World War II, when the discovery of polyethylene as an insulator enabled the British to push the development of radar. Literally, billions of pounds of polyethylene are used. Much of it is used as electric insulation for wire and cable. Other materials insulate motor windings and encapsulate electronic components in our aerospace industries.

Foamed and cast plastics with exceptional low-heat transfer coefficients, high strength, density, stiffness, density ratios, resistance to insects and rodents, are now widely used in the construction industries. Decorative wall panels, piping, valves, flooring, and ductwork are but a few of the many applications in our largest industry.

The New York World's Fair is a plastic-architectural designer's dream of whole walls, roofs, floors, of fiberglass reinforced structures being supported by thin steel structures.

The world of plastics is expanding at a rapid pace. The uniqueness of a teaching approach, familiarity with products no farther away than the telephone, willingness to experiment with a material far more easily handled than metal, will bring the teacher many happy rewards.

KENNETH ROGERS, *Industrial Arts Instructor*
Columbus High School
Waterloo, Iowa

FIBER GLASS REINFORCED POLYESTERS

THE field of reinforced plastics is indeed a unique and challenging one. Its rapid growth since its development during World War II and the adaptations to current industrial products has been almost phenomenal. The design possibilities with this new and unique material have opened up areas for production of products never before thought possible.

It is replacing wood and metal in a variety of products now in use, and from all outlooks this replacement will be much greater in the future. In many military applications reinforced plastics can be used, thereby eliminating the need for natural resources which always become scarce in time of war.

Since this material can be used safely and with a minimum of equipment in the school shop, it is imperative that it be included as a unit of instruction in the total industrial arts program. Whether it be included in a course in plastics or in connection with wood and metal courses now taught is immaterial. It should be included wherever it can be worked in to enable students to become acquainted with the characteristics and possibilities of this new material.

Reinforced plastics can be molded into a variety of shapes and sizes ranging from the simplest to the most complex. Also, the opportunity for self expression in the creation of totally new designs or the modification of existing ones is unlimited with this material. The fact that this material has physical characteristics far surpassing wood and metal, coupled with its ease of fabrication into large and unique structural shapes, will open up a whole new avenue of design possibilities for the students working with it.

I used the following procedure in the construction of an original plaster mold to be used in the lay-up of fiber glass stool seats.

1. Arrive at a basic design and cut templates out of 3/8" plywood. These templates are spaced about six to ten inches apart, much like

the construction used in model airplane building. One or more main stringers can be used depending on the size of the project. The templates are then fastened to the stringer with nails or glue.

2. Steel lath is then nailed to the wooden frame. This steel lath is of a diamond-shaped design and can be easily bent into a variety of compound curves. It can also be cut and spliced if the contour is too great for normal shaping.
3. Molding plaster is then added to a small amount of water until it is completely absorbed. The plaster is then worked into the lath to give the desired shape. If the plaster tends to fall through the lath on the first application, this can be eliminated by holding a paper towel on the back of the lath.
4. After the plaster has set up, the mold can be shaped by using rasps, files, and sandpaper. I found a rasp with a perforated cutting surface allowed the plaster to go through and not clog up the cutting surface as was the case with a normal file. If any low spots develop, more plaster can be added to these areas.
5. After the desired shape has been achieved, the surface of the mold should be sanded until it is extremely smooth. In constructing the mold for the stool seat I had trouble with many small imperfections developing as I sanded. A coat of sanding primer used in automotive-body work was applied and these places were filled with glazing compound which is used in connection with sanding primer in body work. After this had been allowed to dry, the surface was sanded and several more coats of primer were applied, sanding between each coat. This filled up imperfections and sealed the plaster.
6. The final operation to the mold involved giving it four coats of a good grade of paste wax to aid in the release of the lay-up.

The lay-up of the Stool

1. The mold is first coated with two or three coats of mold release. This step is very important as it is very disheartening to have a mold destroyed that has required many hours to build in the removal of the cure lay-up.
2. The resin is mixed with the hardener in the amounts specified by the manufacturer. If color is desired, it is also mixed at this time. Care should be taken not to mix too much hardener and mix only amounts that can be used in the length of work time you have before it will start curing. The resin should be mixed in a container that can be disposed of after the work is completed. A paper cup for small amounts and a coffee can for larger amounts works quite well.
3. In the construction of the stool, I used one layer of glass cloth, a layer of mat and then another layer of cloth. The cloth was cut to size and laid over the mold and resin worked into it with a brush. After the cloth was saturated completely, the mat was cut to size and

resin applied to it in much the same manner. The final layer of cloth completed the lay-up.

4. Let this set-up over night and remove it from the mold the next morning. The lay-up released after a considerable amount of pulling and after it was removed it was found to be sticking in two places on the mold. A more even coating of mold release would have corrected this situation and aided in the removal.
5. The final finishing of the stool was accomplished by band sawing the excess material off and sanding the edges. A coat of resin was then painted over any imperfections. This coat was allowed to cure and then it was sanded and polished.
6. To be able to attach steel legs to the stool, a surface was needed which would be able to hold screws. This was provided for by laminating a ¾″ plywood block to the bottom of the chair with strips of glass cloth and resin.

Purchase Information

Due to the shelf life of polyester resin, I would recommend only keeping a small quantity on hand and having students purchase resin needed for larger projects from a local supplier. I purchased materials from a local boat house which usually stocks glass cloth, mat, and resin for boat repairs. The prices quoted here are the ones I paid for my supplies.

Resin	$1.75 per quart
Hardener	.40 per ounce
Color (1 oz. per qt. of resin)	.40 per ounce
Mold Release	.75 per ounce
Glass Cloth (50″ wide)	1.65 per yard
Mat (38″ wide)	1.50 per yard
Molding Plaster	.05 per pound
Steel Lathe (4′ x 8′ sheet)	1.50 per sheet

DEWAYNE FINTEL, *Industrial Arts Instructor*
Hudson Community High School
Hudson, Iowa

FORMING SHEET METAL BY EXPLOSION

IN this vast advancement of research and development in industry, it is important to have a firm understanding and knowledge of the new concepts that are being used. Industrial arts teachers should be aware of these new concepts in order to approach the problem of properly educating our youth in an ever demanding technical world.

It should be anticipated that new industrial methods brought into the industrial-arts classroom will arouse curiosity and create motivation.

Just what is "explosive forming of metal" and how did it get started? Explosive forming of metal is the use of a high or low explosive charge pushing against a medium, such as air or water, using the force of the charge to form the metal to the shape of the die it is clamped to. The explosive charge is usually confined to a container to direct the action of the force.

How did explosive forming get started? Its discovery is not new. Charles E. Munroe, an American, discovered the method in 1880, and used it for engraving, embossing, or forming metals. Commercially this process was not used until around 1950. Today, explosive forming of metal is primarily used in the space and aeronautical industries.

In order to apply this to an industrial arts program, an instructor should do some research in the following phases:

1. Investigate the industrial usage and methods of explosive forming.
2. Arrive at basic advantages and disadvantages of explosive forming as compared with conventional methods.
3. Experiment and develop explosive formed metal parts with a shop-made unit.
4. Develop an instructional program to be used in an industrial arts program.

Important factors to consider when setting up an explosive chamber are as follows:

1. Use of low explosives are best adapted for instructional purposes such as a .38 caliber blank cartridge.
2. Strength of container should withstand a minimum of 200 pounds pressure per square inch.
3. Vacuum below die is important.
4. Die construction is very important.
5. Metal should be clamped securely above the die.
6. Stand-off distance is important. This is the distance from the charge to the work-piece.
7. Tight seal between lid and container is essential.
8. Firing unit should be constructed with care so that leakage of pressure does not occur.
9. Water on the work-piece is important so that wad from blank does not pierce metal.
10. Die should be securely held in place so that movement does not occur when force strikes the work-piece.

Purchase Information

Firing Unit	1-7/16 x 3½ c.r. Steel
Firing Pin	½ x 4⅝ c.r. Steel
Chambered Barrel	¾ x 6 c.f. Steel, drilled for 38 cal. cartridge. 16 NF threads.
Container	9 x 12 x ½" Steel container or cast iron is sufficient if considerably heavier.
Machine Bolts	10—½ x 3.
Die and clamp material	any type of hardwood is sufficient.
38 caliber Smith and Wesson Blanks	$3.20 /50.
Gasket material	should be soft and pliable.
Metal	22 ga. aluminum.

WAYNE TJELMELAND, *Industrial Arts Instructor*
Vinton Community School, Vinton, Iowa

Epoxy Tooling Resins

SINCE World War II there has been a steady increase in the use of epoxy tooling resins. The construction of dies and fixtures, foundry patterns, core boxes and molding tools of plastics are just a few examples of the use of epoxy tooling resins. Such tools can be produced rapidly and economically. Today, tooling with epoxy resin is an established and widely accepted technique used by industry.

The rapid advancement of industrial research and development in plastics has had an overwhelming impact on industrial methods of production. In this vast advancement of research and development in industrial methods of production, it is important to have a firm understanding and knowledge of the new products that are being used. Industrial educators must be aware of these new products in order to help prepare individuals for meeting these new developments intelligently.

In the past few years, epoxy-tooling resins have played an important role in the patternmaking shops. Patterns, which normally would take days to produce, can now be produced within hours. The unique features of epoxy resins that allow the reduction of time is the surface finish that does not require clean-up. Also, the shrinkage of epoxy resins is very minor, which allows pattern shops to reproduce an exact model.

With these unique features in mind, industrial arts students can produce many patterns for the foundry without spending too much time on construction. At the same time, they are using a method recently accepted by our modern industries.

Basically, epoxy plastic tools fall into three main categories. They are "lamination," "surface castings" and "mass castings," each of which may be used singly or in any combination. In deciding which method would be most beneficial for a specific job, several factors should be considered. These factors would include dimensional stability, shrinkage, weight, labor cost, material cost, strength and toughness.

Laminated patterns are made of alternate layers of glass cloth and liquid laminating plastic. After the laminations are completed, the liquid plaster solidifies into a strong rigid form. The finished pattern has the exact size and shape of the surface from which it was molded.

Surface cast patterns usually consist of a metallic core, usually aluminum or kirksite, cast rough to the general shape of the finished pattern. The core is then suspended over the model of the working face of the pattern and epoxy resin is then cast into the space between the mold and the metallic core.

Mass castings appear to be the simplest method of making foundry patterns. This method is simply preparing the mold and pouring the resin. However, where thick sections are required, more shrinkage is involved. Also, the strength of the pattern is less than the other methods mentioned.

One of the most important aspects of all plastic tooling work is proper mold and model preparation. Epoxy resins will adhere to a great variety of materials. However, with proper preparation, castings and laminations can be taken from wood, plastic, plaster or metal surfaces.

The following steps should be carefully followed when preparing the mold or model to receive the epoxy resins. However, one should always carefully read the manufacturer's instructions before proceeding.

1. Clean surface thoroughly using acetone, alcohol or other commercial solvents.
2. If model or mold is plaster or wood, seal it with lacquer and allow to dry.
3. Apply two or three coats of carnauba-base paste wax and buff lightly with a lint-free cloth.
4. Apply two or three coats of epoxy parting agent.

The suppliers of epoxy tooling resins mentioned here are only a few of the many available. Three suppliers of epoxy tooling resins are Ren Plastics, Lansing, Michigan; Kish Industries, also of Lansing; and U. S. Gypsum, Chicago, Ill.

These manufacturers also have free literature and visual aids available for educational purposes.

In the scope of industrial arts, epoxy tooling resins have many possibilities for developing into a conscientious learning situation. This material has tremendous research possibilities as well as a great variety of uses. The use of this material could very well stimulate students to design unique projects that otherwise would be too difficult to reproduce.

DONALD DARROW, *Industrial Arts Instructor*
Main Street Junior High School
Cedar Falls, Iowa

THE FOAM VAPORIZATION METHOD OF METAL CASTING

FOAM vaporization casting is a relatively new casting process discovered in the last ten years. The process employs a pattern made of a foamed plastic material such as expanded polystyrene, expanded polyurethane, or expanded cellulose acetate. The pattern is not removed from the mold as in more conventional casting methods. When molten metal comes into contact with the pattern, the polystyrene or other plastic material vaporizes and the vapor forms a bond in the adjoining sand. This process has also been called "cavityless casting," "displacement casting," "replacement casting," "the Shroyer Process," "solid mold casting," and "the full-form foam method."

Various metals including aluminum, bronze, and ductile iron have been cast by the foam vaporization method.

Castings have been made successfully in several types of sand including natural bank sand without binder, clay bonded green sand, silica sand, resin coated shell core sand, bench sand, and zircon.

I have limited this report to the use of the foam vaporization casting method employing extruded foamed polystyrene patterns. This type of polystyrene pattern is easily cut with conventional hand or power woodworking and metalworking tools. High equipment operating speeds and low material feed rates are recommended for the production of smooth surfaces. Electrically heated resistance wire cutters are commonly used for cutting and shaping this material.

Patterns can be built up by adhering several pieces of polystyrene together with rubber cement. The density of the pattern material should be between 0.94 and 1.25 pounds per cubic foot.

Since the pattern is not removed from the mold, no draft is necessary on the pattern.

Metal shrinkage must be considered when making a polystyrene pattern just as with any other pattern.

Fillets and rounds should be used because they aid the flow of metal in the mold and prevent shrinkage defects. Small fillets are easily added to the pattern with household paraffin.

Sprues, gates, and risers are made of foamed polystyrene and cemented to the pattern before it is placed in the molding sand. It is recommended that rounds, sprues and risers be used and that they be coated to eliminate as much metal turbulence as possible along the rough sprue wall as the metal enters the mold.

Risers should not protrude above the sand. Difficulty was experienced when excessive oxygen entered the mold. This caused the pattern to burn rather than vaporize. If possible, the sprue should be attached to the bottom of the pattern and the length of the pattern placed vertically. This allows the metal to fill the mold more evenly and smoothly and permits more progressive vaporization of the pattern. The sprue must have enough head to completely fill the vaporized pattern. A large basin of molten metal should be allowed to accumulate at the top of the sprue to assure that the sprue is kept full until the mold is full.

Normal pouring temperatures and fluxing procedures are used.

To obtain a smooth surface on the casting, the surfaces of the polystyrene pattern can be coated with a thin coat of ordinary household paraffin. This paraffin coating can also be used to add fine details to the casting. Another successful coating consists of tissue paper adhered to the pattern with a paste of flour, water, and polyvinyl acetate. The paste is applied to the pattern and allowed to dry. The tissue paper is then dipped in alcohol and placed on the surface of the pattern.

One of the most striking differences between the cavityless casting method and conventional methods is that no binder is needed for the mold sand. Ordinary bank sand can simply be poured around the pattern. Although vibration might be used to insure that all cavities in the pattern are filled with sand, ramming is not necessary. In fact, ramming should be done with care if another type of sand is used to prevent damage to the pattern.

Advantages of the foam vaporization process include:

1. Foamed plastics are easily formed into patterns. Most tools needed for shaping the plastic material are already in the average shop.
2. Polystyrene materials are easily acquired and low in cost.
3. The time required to make an expanded polystyrene pattern is estimated to be about one-fifth the time needed to make the same pattern of white pine. This should encourage the design of new patterns and projects by more students where time is limited. Proto types for design courses could more easily be constructed. A polystyrene pattern might be used to cast a permanent pattern.
4. No core boxes, follow boards, or matchplates are needed for this process.
5. Since the pattern is consumed in the process, there is no storage problem.

6. Reinforcement materials, tubes, bolts, and sleeves can easily be placed in the pattern and cast in place.
7. Little foundry equipment is needed for the foam vaporization process.
8. Sprues, gates, and risers can be made part of the pattern.
9. There is no need to remove the pattern from the mold or make provision for its removal.
10. Castings can be made using ordinary bank sand without a binder.

The main *disadvantages* of the foam vaporization process are:

1. If a casting is unsuccessful, a new pattern must be constructed before another try is made.
2. Acceptable coating processes necessary for the production of smooth surface castings have not been fully developed.
3. Patterns are damaged easily.

Extruded polystyrene foam is available from nearly any plastic materials supply company. It is also available from many lumber yards, insulation dealers, florists, and discount stores. The cost averages $.10 per board foot or $1.20 per cubic foot. When ordered from a plastic materials supply company, expanded polystyrene comes in planks measuring 10 inches x 20 inches x 9 feet, or logs measuring 25 inches x 33 inches x 6 or 9 feet. Smaller cut-to-size pieces are also available. One of the more common trade names for this material is "Styrofoam" which is produced by the Dow Chemical Company.

Expandable polystyrene and self-expanding polystyrene might also be molded into a pattern in the industrial arts shop. These materials are available from the Dow Chemical Company, Midland, Michigan; Howland Plastics, Gilman, Iowa; Koppers Company, Inc., Pittsburgh, Pennsylvania; and United Cork Companies, Kearny, New Jersey.

The average cost of expandable polystyrene is $6.50 per 10 pounds.

I feel that the best use of the foam-vaporization casting process in an industrial arts program would be as a way to encourage student exploration and experimentation in design. It is not suggested that this process replace other established founding practices but rather that it be used to supplement existing practices.

L. S. WRIGHT, *Professor
of Industrial Arts,
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Cedar Falls, Iowa*

THE INVITATIONAL DRAFTING CONFERENCE—A NEW DIRECTION FOR HELPING DRAFTING TEACHERS

MY purpose in being here is to share the concept of our Invitational Drafting Conference. The idea of such a conference is not new. An Invitational Drafting Conference held in several geographical locations in Iowa is new.

Plans were made for the first conference.

In addition to the three suggestions just mentioned characteristic features of the conference included.

1. An exhibit of high school level drafting textbooks.
2. A 30-minute presentation by a practicing architect followed by a 15-minute period for questions.
3. A 30-minute presentation by a mechanical engineer followed by a second 15-minute period for discussion.
4. A coffee break.
5. Buzz sessions for the conferees to discuss appropriate drafting content at the junior and senior high school levels.
6. A buzz session summary report to the entire group.
7. Prompt adjournment of the conference.
8. A post-conference mailing including a summary of the main speaker's reports (taken from a tape recording) and an evaluation form for comments.

The conference seemed to be a real success. No one had to drive longer than 45 minutes to attend. Speakers were careful about their allotted time and presented down to earth material and examples. The group was small enough so that teachers were willing to question the speakers. The buzz sessions provided an opportunity for teachers to exchange ideas and to discuss issues which had been identified by the two speakers.

Men who are teaching drafting, generally, are not properly prepared for this. Every teacher of drafting should have had some significant work experience on the drafting board.

Drafting in too many schools has been a lost child. It should be taught as a primary field because it is so important. Drafting is not just drawing lines. It is a significant field of knowledge. Everyone sooner or later is going to have an opportunity to use whatever knowledge he may have along the lines of architecture or drafting.

Drafting is the ability to make, read and interpret plans. Whatever their lifework your boys need this ability. For example, we do business with church building committees. These are made up of men from all walks of life. They must be able to interpret the presentation drawings of the architect. They have a trust from their congregations to get for them the soundest and best facility that their money can buy. They should know exactly what they are getting. This is true also of school boards, and all instances where committees are involved in building.

Drafting including orthographic projection and descriptive geometry will help anyone to a better understanding of many things regardless of whether the individual ever becomes a draftsman. A study of drafting helps to break the whole into its individual parts and to see the relation of the parts to each other.

It helps the individual to appreciate balance and symmetry and build the whole from a group of parts.

Probably not more than one student out of five will engage in work that will involve actual drafting practices. This means that your program should be flexible enough to meet the needs both of the one who will use drafting directly and the four who will use it indirectly.

Industry needs draftsmen. The want adds of last Sunday's paper showed the need for the following: "$740 per month. Use your drafting background as the springboard into public relations or sales engineering"; "Need a draftsman for trouble shooting in construction work"; "Draftsman to assist a plant owner for $120 per week"; "Product development, includes profit sharing"; "4 draftsmen for layout work in design engineering"; "High school graduates needed with drafting experience to grow into engineering"; "Tool and design draftsman needed."

Those with a background in drafting have many opportunities for jobs as estimators, salesmen for building products, trouble shooters, and others. A good estimator may draw $12,000 a year or more.

With the new materials and processes, much more responsibility is given to the architectural draftsman. As far as the architectural draftsman is concerned, there will be very few come out of high school whom we can use with only high school preparation.

It takes about three months before a new draftsman begins to earn his salary in our industry.

A good draftsman must be able to work with people. He must also have the initiative to solve drafting problems lasting as long as a month or more, without losing interest.

Our people must be punctual. When our clients come in to meet someone at 8:00 in the morning, our personnel must be on hand. Oversleeping, flat tires, cars that won't start are not valid excuses and generally this cannot be tolerated.

In the construction field, the difference between a common laborer and a foreman is simply the ability to read and interpret a set of plans.

Some school drafting courses try to cover too much. It would be better to teach the fundamentals well and let the specialties go until we know which ones are needed.

Every student in drafting should take shop including, especially, an understanding of machine tools, welding, measuring tools including micrometer, Jo-blocks, calipers and the like, and the differences between castings, forgings, stamping. This type of knowledge is essential to practical dimensioning practice.

High school students should develop more skills in use of trigonometry, trig tables, descriptive geometry, and engineering handbook usage.

The methods used in teaching drawing in some school systems are not generally those used by the architect. Drawings that are prepared in schools are prepared on paper that we use to put our tracing paper on. This makes a real difference to effective drafting. The manila papers that you use react quite differently to pencil work than the papers used by our office. Every drawing made in drafting class should be on a tracing medium. The mylar films which we use require an entirely different technique of pencil work.

Instruction should be up-to-date and include at least some of the newer materials—mylar, pencils for drawing on films, pre-printed title strips, templates and the like.

New developments in tracing papers and pencils helped to bring about changes. Formerly, drawings were done with India ink. Now they are done with pencil on tracing media. These and the new reproduction techniques make it possible to get good reproductions from well-executed pencil drawings.

Drafting students should have some experience with inking but major emphasis should be on pencil work.

Use of equipment should be balanced. Football teams are outfitted in the finest clothes money can buy to teach them how to play the game. Should we have the same quality of equipment to teach them how to make a living? The answer seems obvious.

Large, expensive sets of drawing instruments are simply not used in industry. Among the tools that a draftsman really needs is a $4 to $6 bow compass, a 45-degree and 30-60-degree triangle, a scale and an erasing shield and templates.

Line weight is a function of pencil hardness rather than line width. More emphasis should be placed on line contrast. Arrowheads should maintain their proportion of 1:3 and should not be too large.

General drafting techniques is important. Students should learn to distinguish between what is needed and what is unnecessary. The architectural draftsman seldom if ever should use a pencil as hard as "4H." The range of pencils for most draftsmen should be from "B" to "3H" depending on his individual touch.

Some architectural offices are using the dot but it is not replacing the arrowhead.

The parallel straight-edge is especially useful for the architect because of the long lines he must draw. We use printed borders and title blocks.

It is assumed that a draftsman entering our employ will have a command of the techniques used in the preparation of a drawing. Line work must be sharp and dense for good reproduction. Lettering must be clear and legible. Height is governed by the use to be made of the lettering. Microfilming requires lettering within the range of .12″ to .20″.

The first tool a draftsman receives in our industry is the company drafting manual. It shows general practices and procedures for the presentation of engineering drawings. Uniform drafting practices are required for accurate communication.

Students should know the American Standards Association Drafting practices and be able to apply them in their work.

There are several manuals put out by the American Institute of Steel Construction. These are heavily used as references in structural drafting.

High school students are short on basic drafting fundamentals including line work, dimensioning, lettering, and making projections, views and sections.

An amateur draftsman can quickly be detected by looking at his lettering. All of our lettering is vertical and most of it is upper case. I use guide lines for all of my lettering. Others think they are not needed.

Among the first impression an applicant makes in applying for a drafting job is the completed application form. Some applicants make such sloppy applications they eliminate themselves from serious consideration for a position.

We use the LeRoy or Wrico instrument only for presentation drawings and sometimes for title blocks. Freehand lettering has more character. Some offices have a large typewriter to type directly on the drawing.

Free hand sketching should be emphasized. To teach only the use of the T-square and instruments is to do only half of the job. Every student should be able to sketch as a means of rapid communication.

The ability to draw in two dimensions and see it in three dimensions is the most important of the things to teach.

Students must be taught to visualize. To this end, ideas should be taught not just memorized.

Students must know scale. Some seem to know neither architectural nor mechanical scales nor the differences between them.

One of the problems of teaching structural steel drawing in high school is that only depth is drawn to scale. Length is not scaled. The depth is scaled to show exact locations for rivets or where the welding of girders is to be.

It may be important to learn the nomenclature of gears. High school students can spend their time more profitably on basic work than on drawing of gears.

Developments and intersections are a specialty required of a very few practicing draftsmen. Comparatively much more time should be spent on orthographic projection and very little on developments.

Be cautious about simplified drafting. The worker in the shop must be able to read about drawing.

Think of the materials used when drawing them. Do not try to specify wood to the nearest thousandth of an inch when a wood member may easily deflect a considerable distance.

All dimensioning in our unit is now based on the decimal inch. We use two figures after the decimal point unless closer tolerances are required.

All working dimensions should have tolerances which may be found on the drawing or in supplementary specifications. These should permit greatest speed and economy of production without any sacrifice of the functional relationships of parts.

Cumulation of tolerances must be checked. The draftsman is expected to know that tolerances are required and the form in which they are to be specified on the drawing. Tolerances also involve conditions of straightness, flatness, parallelism, squareness, symmetry, and roundness. Production methods cannot produce perfection in form. Therefore, tolerances for these must be specified.

One type of tolerancing involves specifying the position of some feature with respect to some other feature. An example is the concentricity between diameters of a multi-diameter part. Tolerance will give the permissible amount of eccentricity. This type of tolerancing is used in applications involving non-hole diameters and fixed fasteners or studs.

Printing and reproduction are very important. Blueprint men are hard to come by. Through the use of sepia sheets, colored sheets, intermediate sheets and the like, considerable efficiency in our office can result. Especially on multi-story buildings the basic layout can be made. Sepia sheets can be made of this. Subsequent floor plans can be drawn on these sepia sheets. Slip sheets can be used of portions that must be re-designed. This may result in a saving of $4.00 to $4.50 per hour, plus benefits. It is a matter of economics to use these new means of reproduction of drawings.

Industries generally welcome cooperative attempts to enrich school drafting programs. Students should study actual drawings from industry.

Bring in a draftsman to talk to your drafting class. Let him demonstrate to the class how he handles his equipment. Importance of speed should be stressed right from the beginning. Get in the habit of twirling the pencil to keep the point.

Take students to a millwork plant, show them shop drawings, see the objects turned out. Visit an engineer's office, an architect's office, and a job site.

No matter what else you do, insist on accuracy. In architecture there is no room for an error. When we prepare drawings, we start with a main floor plan. When it's done we develop foundations, other floor plans, elevations, mechanical work, sewers, heating and others. If there is an error on the basic floor plan, that error can compound itself through as many as 175 sheets. When such an error is found, it would take a draftsman three weeks or a month to straighten all of this out on all of these sheets.

On one of our projects an improperly made numerical 3 was interpreted on a plot plan as an 8. When this error was discovered, the excavation had already been made and the footings poured for a home for the aged. The general result was that this 416 foot long building was being built 5 feet farther into the ground than was intended. Specially designed support columns 5 feet high were built on top of these footings. All of the excavated dirt that had been removed and more had to be hauled back for fill. Many hours of work should not have been done in the first place. The cost of correcting that one little error was $76,000.

What is the point of all this? It is simply this: When a highly paid man well-respected in the community, obviously in a leadership position, tells a conference how he lost $76,000 because of one poorly executed numeral, the members of this conference listen. They go back to their classrooms with a new reason for doing a more effective job in the area to which they have committed their occupational life. For those who have attended one of our invitational drafting conferences in Iowa, our speakers have performed an invaluable service and we believe we are better teachers of drafting as a result of their help. Perhaps you could organize this type of effort in you locality.

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INDUSTRIAL ARTS IN SPECIAL EDUCATION AT THE SECONDARY SCHOOL LEVEL

THESE recommendations are made on the basis of one semester of teaching two classes of industrial arts for boys with an I.Q. range of from 51 to 106, plus the reading I have done to try to make my teaching of these students more effective.

First, it is necessary that the teacher develop the proper attitude toward the mentally retarded student in order to be effective. Teachers of the mentally retarded students will experience many moments of frustration in learning to work with these students.

In our present public school situation, industrial arts teachers are better-qualified to teach these students than any other subject teacher. I am making this statement, because we, as industrial arts teachers, have the training and facilities to provide these students with a phase of education that is unique to our field.

The specialists, who are developing curriculums for retarded children are strongly recommending a good industrial arts program for these students.

The teacher must be willing and able to change his teaching methods to suit the individual situation. It has been stated many times that a teacher of the mentally retarded should forget about the teaching methods he learned in his college training.

I found it would be quite erroneous to approach a teaching assignment with this idea in mind.

I had to use everything that I learned in methods of teaching. The real problem lies within the individual teacher learning to adjust himself to accept the quality of work that these students can do and to evaluate them in terms of their ability.

These students cannot be stereotyped. The emotions ranged from violent to timid. For the most part, they are gregarious, anxious to work when they can understand what is to be done, love attention and understanding, and of utmost importance, they are looking for and enjoy leadership.

They like projects that are simple and easy to make. They enjoy making jewelry from plastic and metal, and various articles from leather. They like to put their names or initials on the jewelry and leather projects.

The project, as far as the teacher is concerned, becomes a mass production affair. For the students, each new project is a new learning experience.

They like to be like any other student in the school. Most of them enjoy working in the shop and are quite willing to try to make projects. However, they are extremely impatient with any planning before a project begins. They lack the ability to excel, but they are extremely proud of a project when it is completed.

The teacher must do the planning for them and must plan enough work for each student to keep him busy. These students are overcome with anxiety if their job is terminated before the project is completed.

Teachers should also plan to make finishing operations as simple as possible. In the case of wood projects, a combination sealer and finish coat should be used. It is a good idea to try to have finishing done at a specified time, so that the teacher can supervise the students.

To help give these students a sense of responsibility to the school and to themselves, three committees were organized. They were a school citizenship committee, a cafeteria committee, and building-grounds committee.

The school citizenship committee was organized to give the students a role to play in the management of themselves and the general upkeep and appearance of the school. A certain amount of destruction had been occurring around the school. This centered around the rest rooms, where towel dispensers, toilet tissue racks, and mirrors were being removed.

The boys agreed to see that these items stayed where they belonged. They also washed all of the names off the walls and found the wastebaskets.

This committee worked for the full year and the results were really a blessing to the school. The pride these boys developed made a terrific change in their attitude in school.

The cafeteria committee was organized without my help. These boys want to keep the cafeteria clean. They helped by keeping the tables clean, emptying trash, and keeping the floors clean during the three lunch periods. They did an excellent job in helping to keep the cafeteria in excellent shape.

The buildings and grounds committee was excused once a week from the regular class period to clean dirt off the hall walls or to wipe the footprints off the locker doors. The rest of the boys went outside to pick up any debris that had accumulated during the week.

I would like to emphasize that these extra activities did not take the place of industrial arts. They were a means to let the students develop the many objectives that we list in defining industrial arts. Two of the very important ones being, personal development and citizenship.

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INDUSTRIAL ARTS IN SPECIAL EDUCATION AT THE ELEMENTARY SCHOOL LEVEL

THERE are three distinct objectives for the inclusion of industrial arts experiences at the elementary level in programs for the mentally retarded. At this level these children have one outstanding need. This is the need for success in their academic endeavors.

All too often, because of their limited abilities they are frustrated in most of their educational endeavors. This need and its satisfaction lays the foundation for future educational success.

Because of its innate ability to meet the needs of pupils of almost any level of intelligence, industrial arts is a natural. If it does no more than provide this basic success and encourage the pupils to go on for further school work, industrial arts justifies its inclusion in a special education program.

Another objective is the pre-vocational, and quite often the actual vocational impact which industrial arts can provide. Very often the industrial arts experiences are the only vocational experiences these students will ever know. Students go immediately from the intermediate school program into sheltered workshops and with minimum difficulty fit into the production program.

The third objective, is that of utilizing industrial arts experiences as a method of instruction in these special education programs. It is here that industrial arts can perhaps make its greatest contribution.

All of us have had occasions when we have been able to assist some pupil to better understand some academic problem through an industrial arts experience. This objective in the regular school program has been firmly established.

In the field of special education industrial arts may be utilized as the main component of the academic unit. Programs of elementary industrial arts have been doing this for years. It is really nothing new. However, because of the need of a feeling of success, because of its unique ability to meet individual needs, industrial arts appears to be the logical method of presentation in special education.

(A film demonstrating the work being done at West Virginia University in the area of special education was shown at the conclusion of Mr. Brennan's talk. It is available to interested groups or individuals through the file library of West Virginia University. It is available on free loan and requires only return postage.)

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SOME CONTRIBUTIONS OF THE INDUSTRIAL ARTS TEACHER TO CHILD DEVELOPMENT

IT is a privilege to share with you some glimpses of childhood because you, as teachers of Industrial Arts, have the opportunity of being especially meaningful persons in the growth experiences of children. As we review a few characteristics of children, I am sure you will recall many incidents from your experiences.

A child's values are quite different from an adult's in regard to "things." To a child, the sight of a fresh field of dandelions is a thing of beauty. When he wants to share this joy with an adult, he brings a bunch of the dandelions and is shattered by the harsh rejection, "Take those dirty things away. See how they stain your hands and clothes." Thus he learns that sharing can be an unpleasant experience.

Children need many successes in order to utilize even a little failure constructively. Each small success helps them to become more willing to try new experiences.

Growth takes time and recognition. Children need help in looking back at their mistakes and recognizing how far they have come in ability and understanding.

Children are great imitators and they expect "big people" to be doing the right thing. They are quick to recognize a disparity in what the adult says and what he actually does.

Children want limits and discipline. However, each needs the constant reminder of the distinction between his actions and his personal worth.

Every child needs love and the ability to relate to others and the opportunity to develop empathy for his peers and mankind.

These six characteristics of children provide a foundation on which you, as teachers of Industrial Arts, can make fine contributions to the growth of children.

Each year I ask college students to write a brief paper describing the teacher whom each feels has contributed most to his maturity and growth, and to include the means used by this teacher to obtain the growth. The answers are enlightening! Some students report sorrowfully that they never had such a teacher.

Others tell about the thorough knowledge of the subject taught and the careful planning of each lesson, made more meaningful by a sense of humor, patience, and love of children.

It is so easy to give "lip-service" to our ideals of meeting individual needs, of reverence for personality, and of taking a child where he is and building from there. You all know these goals.

Have you thought about the strides that could be made for children if all of us put into practice the results of the research that has been done already? We know the value of the data. It is so easy to talk about, but so hard to use it in the classroom. How well do you know the children in your classroom?

Are they just numbers assigned to periods in your over-crowded schedules? Or, do you make an opportunity to recognize and meet the needs of these students?

If there were more time, we could take each child on your roll and mention some of his special needs and attributes, and the ways in which you as a teacher of Industrial Arts, contribute to each child's growth.

I hope you realize how very important you are, each of you, and the members of your professional group. You have all the boys, and I hope as the years go by, you will have an increasing number of girls.

You have the awesome responsibility and privilege of being an image for the finest and best in manhood, for helping these boys get a new look at themselves as young men, for helping them to be doers as well as thinkers.

The boys look to you for new techniques in solving problems, for a feeling of personal worth, for encouragement in their needs to create, and for finding ways of personal success.

They look to you as an image and a person who may be the first person to in developing skills and co-ordination, to provide a variety of opportunities for them to explore, experiment and select, for worthwhile goals of work, and for opportunities to express feeling, attitudes, values toward self, others, and things.

They look to you as an image and a person who may be the first person to help them find who they really are, what they want to be, and how to get there.

Yours can be the greatest responsibility and privilege in the school system. I know you will fulfill it well.

ROBERT VAN DEUSEN,
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THE ROLE OF INDUSTRIAL ARTS IN THE ELEMENTARY SCHOOL CURRICULUM

WHAT is the role of Industrial Arts in the elementary school curriculum? First, we must look at what we believe industrial arts is or ought to be. Secondly, what we believe the elementary school curriculum ought to be in the broadest sense of the word.

I would agree with Good's interpretation of elementary school industrial arts, which says it is "Informative and manipulative work offered in the first six grades, involving tools, materials, processes, and products of industry as they relate to home and community life."

The curriculum is defined by Kenneth Husband as "all the experiences planned and provided by the school in which the pupils participate."

We now have two simply stated interpretations, but what organization do we use and how do we go about planning industrial arts experiences for all children?

I would submit to you *one* organizational pattern that seems to work effectively. We in Great Neck work in a consultant program whereby areas such as industrial arts, home arts, art, science, and speech, are all non-scheduled types of activities. We believe it most advantageous to be able to work with children at the most opportune time in a child-centered curriculum. How is this accomplished?

Since we consider the classroom teacher the core of the educational program with chief responsibility for the total curricula of the child, the industrial arts consultant's function is to aid her in the manner she feels will best serve the needs of her particular class or, in some cases a particular child.

The consultant keeps in touch with the current classroom problems. He is alert for opportunities to use his specialized training and ability to broaden the educational concepts and learnings of the children.

Although the greater part of all shop activities are integrated into and correlated with classroom living, we believe that the industrial arts area has unique values in itself.

The industrial arts consultant is a person with specialized knowledge and techniques. These special abilities enable him to enrich the child's program in manipulative skills and techniques. In the use of tools and various media the child gains new insights into and appreciation of his environment.

Elementary school industrial arts, by its very nature, requires a child to learn by actual employment of tools and materials. In the kindergarten, the children are introduced to the correct use of the hammer and saw to start with. The group is given many small pieces of wood of various sizes and shapes.

After a period of experimentation, the industrial arts consultant may give specific instruction in the building of a simple train, truck, airplane or automobile with emphasis on why wheels need to turn freely and how this can be accomplished. While striving not to inhibit freedom to experiment, an attempt is made to develop in the children some appreciation of the need for planning.

In general, children learn best when learnings are related to the classroom environment. Nevertheless, for special techniques and for continuity of skills and concepts, there are many times when the consultant must teach children in either large groups or in small groups.

There are also times when he should and does conduct workshops for in-service education of teachers. There are still other times when he is strictly a resource person with all types of materials, supplies and suggestions at hand.

The industrial arts consultant services are not scheduled. To do this would defeat one of the basic principles it was founded upon. Flexibility to move with a group when they are ready to move; being available for planning sessions; in a word, to be able to help a class or a particular group when they need it.

We have been talking about consultants and a consultant program. What is a consultant and what sort of training should he have? Carter V. Good describes a consultant as "a professionally trained person on call to offer guidance and help in promoting and improving the educational program."

He should have keen insights into the needs of young children and understand their social, emotional and intellectual development. He should unmistakably be industrial arts orientated and trained—that is, if we are really trying to foster industrial arts concepts and not arts and crafts techniques.

What do we hope to accomplish through industrial arts in the elementary school? Two of the outstanding values of an industrial arts program in the elementary school are: to help foster, enrich and *extend* concepts being taught in the classroom and to help enrich a youngster's background of our technological society.

If we glance back to what we feel industrial arts is or ought to be, we find certain words need repeating—"first six grades—materials, processes, and products of industry." All school-age children need, desire and have a right to industrial arts experiences throughout their school life. This includes kindergarten-age children as well.

If we were to choose, randomly, any one area of the curriculum at any grade level, we would find industrial arts experiences would be of some benefit to most youngsters. Whether it be from planning a unit, researching a unit, drawing or sketching, laying out materials, problem solving, using tools in actual construction, painting or finishing, or in giving oral reports or in making written reports on units of study.

One point I would like to stress here, and that is, if we purport to help enrich a child's background of our technological society, then we have an obligation to do so. We sometimes do not grasp an opportunity when it presents itself.

One of the greatest strengths we can develop with the professional staff we are associated with is in becoming "the" resource person on the staff.

Who else in an elementary school building is more qualified to talk, discuss and stimulate thinking on conservation, the lumbering industry, steelmaking, the graphic arts industry, the building trades, mass production techniques, etc., than the industrial arts person?

We fully realize the importance of first-hand observation by young children in gaining a better understanding of our "modern living." If it becomes impossible to set up an excursion or field trip to a nearby production center for the children, perhaps you might explore the possibilities of making the trip by yourself or with other staff members to take pictures or slides. When youngsters view slides of things happening in their own locale, it tends to reduce abstractions into realities about their dependency on others.

We are not inconsistent in our thinking if we do not feel everything the children make or work on has to come from the classroom or from the curriculum. On the contrary, many intrinsic values are derived by youngsters while in the process of making something personal.

As long as a youngster feels whatever he or she wants to make is useful, helpful and wanted by someone; as long as planning has preceded construction; as long as the idea has been thought out carefully; then why shouldn't they have the opportunity to grow in their attitudes and skills relating to tools and materials?

On the periphery, there are many ways an industrial arts program contributes to the overall learnings of children, other than the ones that have been mentioned.

I'll not mention the contributions made in helping blind children orient themselves in a normal elementary school.

Nor will I mention the countless times youngsters with limited capacities or youngsters with emotional problems have been helped in a variety of ways.

I would, however, like to dwell a moment on another aspect that deserves recognition. If you are fortunate enougs to have a well-stocked library in your school, you might consider this.

Instead of you, the industrial arts person, furnishing background material to youngsters for researching a project, give them the opportunity to use and develop their library skills. Not only will their library skills be strengthened, but many others as well. You will be doing them a great service for years to come.

If we could summarize, in a word, we might say the place where science, mathematics, social studies, and language arts come alive in the elementary school can often be in the industrial arts laboratory or in the industrial arts work area in the classroom.

If we could look toward the future for just a moment, I would say we have just begun to scratch the surface in regards to experiences offered to children in the industrial arts area. We have gained a little ground over the past few years, through the efforts of many. But even more important than this is the fact that we have little or no time at all to stand still. With the addition of foreign languages into the curriculum; with the "new math" being instituted in many school districts, we must be alert and flexible enough to try new things ourselves.

Many of use are in hopes that our new *Council* will be able, in the very near future, to disseminate information, ideas, curriculum changes and other pertinent information in a publication especially designed for and by elementary school industrial arts personnel. If there could be one central clearinghouse for all kinds of material, then we all might gain a better insight into the problems confronting us as a group, regardless of the geographic area we live in.

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THE ROLE OF INDUSTRIAL ARTS IN THE DEVELOPMENT OF THE ELEMENTARY SCHOOL CHILD

THE fullest possible flowering of human potentiality is the business of education."

This statement, from the 1962 Yearbook of the Association for Supervision and Curriculum Development, is of a deep and profound significance to all who are engaged in educational endeavors.

It has taken us two centuries to make this pronouncement with the courage and conviction with which it is now stated. Two centuries ago, Rousseau said education "is the growth of capacities with which human beings are endowed."

We have been nibbling at the fringes of this goal, apparently reluctant and unwilling to embrace a full commitment to the development of the total spectrum of human potential. We have been wastefully occupied in putting certain human potentialities on a value scale, trying to develop those which were labeled more desirable and deal with them as separate entities.

We cannot deal successfully with the human being in piecemeal fashion, even if we could agree which potentialities are more valuable.

To accept the development of total human potential as our ultimate goal in education means, among other things, that we are and must be simultaneously reaffirming our faith in the individual.

Our authoritarian culture has long viewed the sciences of psychology and sociology as studies which would reveal to us how we could manipulate the individual toward socially accepted ends.

However, manipulation is anti-potential releasing. Therefore, we replace the idea of manipulating, with a faith in the basic nature of the human being who when functioning freely is constructive and trustworthy.

It has also become clear that if we accept development of human potential as our ultimate goal in education, there must be a great diversity in the kinds of experience we offer children. We can no longer argue that the school curriculum is bulging. It is bulging the school day time-wise because we are insisting every child go through precisely the same schedule every day in lock-step fashion with meager regard for the personal meaning which these activities have for each child. The result is wasted time for the individual involved.

We must move toward a greater degree of individualized instruction.

If this goal is fully accepted by us and our colleagues in education, we shall soon see that you and I, as professionally prepared persons in industrial arts, have a staggering responsibility in this "business of education."

One approach is to identify what the human beings' potentialities are. The evidence of human capacities surrounds us.

DeHaan and Doll suggest four broad categories which include the liberal arts and humanities, science and technology, corporate and political living, and anthropology.

We cannot escape our specific responsibility, as industrial arts educators, of developing potential in the technological area.

I conceive technology to be those techniques, means, methods, devised by human beings to enable human beings to cope effectively with the physical environment. Industrial arts are those arts or techniques which can be utilized appropriately to deal with large quantities of materials for productive purposes in a highly efficient organized manner.

How can we release and develop human potential in the technological area? I believe the experiences which we design for children in this area should have certain earmarks, and that these earmarks approximate some of the factors or conditions which will serve to release human potential in this area.

One is that the activity, or techniques explored in the activity, should have some personal relevance to the child. Let me illustrate.

The children in a fourth-grade class had been studying maps, explorers, and the compass. Closely related to this study are the significant techniques devised to enable man to orient himself on the earth's surface, and to make graphic representations, or maps, of the earth's features.

How can children relate personally or derive personal meaning from this knowledge or these facts? The children's appetites were whetted with an authentic looking treasure map. There was indeed a real treasure buried.

To find it, one must be able to measure distance and read bearings on a transit. Not only this, they would construct their own transits in the industrial arts laboratory. This they did.

They learned to measure distances by using their own strides. After construction of the transits, it was necessary to practice using them.

There was a dry run in the laboratory. This was a very interesting game, involving giving a degree reading, for which one must name the object sighted at this particular bearing. This meant orienting the transit with a compass. One was never handed a transit already oriented.

Finally the day arrived for the treasure hunt. With transits and copies of the map, the class set out in groups. Two and one-half hours and approximately one-fourth mile in paces later, one group hit pay dirt.

Did these facts and techniques come to have personal meaning for the children? If enthusiasm, excitement and sheer joy were any indication, then there can be no doubt about it.

One thing was also noted. It was agreed beforehand that the treasure would be shared with the entire class. In deciding who would get a transit (there was one per group), we found the children were just as anxious to own the transits as they were to have the candy, pennies, and jewelry found in the treasure chest.

Another earmark important to the development of human potential is that the experience must be within the cognitive, psychomotor and affective abilities of the children. Success in utilizing technique to cope with the physical environment cannot be underestimated.

Still another earmark of a good experience is that it will introduce some new skill or concept to the individual child. Changing a project from a birdhouse to a birdfeeder is not providing for the novel.

In a well-designed experience for children, there will be a cognitive challenge and appeal as well as a psychomotor challenge and appeal.

All too often in industrial arts we have been prone to emphasize the development of a high degree of psychomotor abilities, the manipulative abilities, and have minimized the rich cognitive content inherent in technology.

The next earmark of a good experience concerns the designer of activities for children. The designer of experiences for children must have an appreciation, an emphatic feeling, a sensitivity to a child's pleasure in discovering.

All too often, we evaluate human created techniques with an air of adult sophistication which serves to nullify our ability to enjoy children's discovery of these techniques and even to obstruct the design of the experience itself.

If we truly accept this goal of developing total human potential in our schools, how long must we wait to be able to implement elementary school industrial arts programs nationwide? Or is it to be for just a privileged few?

One step in the right direction is to eradicate present limitations. We contend that industrial arts experiences should be available for all, a part of everyone's general education. Yet, in practice, these experiences are virtually exclusive to the male on the secondary level.

There are several reasons for this. Most of them are rooted in our cultural heritage. The elementary schools have been taught primarily by women (87 per cent of our present elementary teaching force). Industrial arts has been considered a male's field.

I am not suggesting we now have an all-out campaign to recruit girls and women to industrial arts.

I am suggesting that every person, male or female, have a right and an opportunity to develop his or her own potentialities in whatever area of growth his or her interests suggest without threat of ostracism and skepticism because of choice.

We must become as knowledgeable about the development of our learners as we are about technology. I strongly recommend we pursue this riddle of developing human potential, that we research this not only in our doctoral dissertations, but as a part of our other professional endeavors.

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ORGANIZATION AND TEACHING OF THE ELEMENTARY INDUSTRIAL ARTS PROGRAM

ROCHESTER, New York, has eight comprehensive high schools and one technical and industrial high school. Basically the education program is divided into a 7-5 plan. The industrial arts program is divided into the following organizational pattern:

Integrated handwork, kindergarten through seventh grade, boys and girls
Elementary industrial arts, sixth and seventh grades, boys only
Junior-Senior high school industrial arts, eighth through twelfth grade, boys and girls

The integrated handwork program is carried on in approximately half of the elementary schools. A teacher is assigned to two schools to conduct a program of handwork which is a direct outgrowth of the classroom units of instruction.

At times the handwork teacher will go into the classroom to work with groups. At other times the class or a committee of that class will go into the shop for constructional activities.

The students are acquainted with a variety of raw products, processes, tools, and materials. They build an appreciation for the skill, ingenuity, patience, and time required to produce a finished product.

The students are given an objective media for expressing purposeful ideas and helped to discover and to develop natural abilities. They are placed in a natural social situation through which certain character traits can be observed and developed.

The classroom teacher utilizes handwork in order to add dimension to learning situations, stimulate purposeful reading and accurate observation and group research, and to add variety to classwork. Handwork provides an opportunity to apply principles of construction and design and to develop and encourage creativity.

The handwork teacher schedules the activity according to the overall needs of the school and the individual needs of teachers. The classroom is used whenever possible for the handwork. The equipped room is used only for those activities not suitable for classroom undertaking.

The school principal suggests and evaluates proposed activities and encourages full utilization of the program by all the teachers.

Pupils have an opportunity to work with such materials as wood, metal, ceramics, reed, raffia, leather, paper mache, foods, and clothing.

The other elementary schools in Rochester have a more traditional industrial arts-homemaking arrangement. This program is concerned with introducing the boys to basic tools and developing desirable work habits.

All sixth- and seventh-grade boys are assigned to the shop one period per week for 40 weeks where they are given a variety of tool experiences in the areas of wood, metal, electricity, ceramics, and crafts.

Industrial arts on the junior-senior high school level is basically exploratory in nature and is concerned with teaching about industry, rather than for industry. Programs vary from a three-shop organizational scheme in two schools to an eleven-shop organizational scheme in the largest secondary school. As a result, the specific offerings must, necessarily, differ in the several schools.

However, the basic program, which makes industrial arts mandatory for most at the eighth-grade level, elective for boys and girls at the ninth, tenth, eleventh, and twelfth-grade level, is quite similar to all schools in the system.

It begins with comprehensive courses of general shop nature in the junior high school and proceeds to the more specific unit shop courses in senior high school. The program is arranged so that pupils have experiences in two or three shops or areas before they specialize in any one. Along with shop work the pupil is encouraged to take some work in drafting.

The courses include a general shop class with areas in wood, ceramics, and crafts; a general shop class with areas in metal, graphic arts, and electricity; a general unit in wood; a general unit in metal; a general unit in electricity; a general unit in graphic arts; a general unit in transportation; and drafting.

Unit shops offer beginning and advanced courses of study for a full year. Some programs offer ceramics, crafts, home maintenance, textiles, etc., for a 20-week period.

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EFFECT OF PROGRAMED INSTRUCTION UPON INITIAL LEARNING, RETENTION, AND SUBSEQUENT LEARNING FROM A TEXTBOOK

THIS study was an experimental investigation of the relative effectiveness of a standard textbook, a linear program, and a branching program for teaching a unit on screw thread terminology and thread standards. In addition, the study was designed to test for any effect of the three experimental treatments upon subsequent learning of a second learning task, a unit on metal forming processes, presented by means of a textbook selection.

The development of the linear program followed the recommendations of Skinner (1958) with an attempt to utilize refinements proposed by the Center for Programed Instruction (Markle, Eigen and Komoski, 1961). Each frame appeared on a separate page, and included a question. The answer to the question was on the reverse side of the page. Illustrative material from the textbook presentation was reproduced as a booklet of figures and tables to be used with the program. The linear program was administered to a number of individuals and revised on the basis of their performance and suggestions.

In order to develop the branching program following the techniques outlined by Crowder (1963), it was decided that the textbook exposition could be sub-divided into fifteen units of presentation for use in the branching program. The branching program was developed to present one of these sections on each of 15 different pages.

At the bottom of each of these pages, a multiple-choice question with three responses was included to test the understanding of the informational content on the page. The branching program was assembled in the scrambled book format. Instructions after each alternative answer to a question directed the subject to a page appropriate to his answer to the question.

If the student had selected the correct answer, he was directed to a page which informed him that he had selected the correct answer, and directed him to turn to the next information page. If the student selected an incorrect answer, the page to which he was directed contained an explanation of the error, and the student was directed to return to the question page, read it carefully, and select another answer to the question.

The potential experimental population consisted of 301 students or the entire male student population in grades seven, eight, and nine of the cooperating junior high school at the time the experiment was conducted. Grade level in school was used to assign the subjects to the three levels required by the experimental design. Within each level, subjects were randomly assigned to the three experimental groups and to the control group.

Two days were required to administer the experiment. During the first session, subjects in the experimental groups received the three experimental treatments, while the control group received an irrelevant assignment. All subjects, including the control group, received the criterion test for the first learning task.

Ten days later, the criterion test for the first learning task was again administered to all subjects. The treatment for the second learning task was then administered, followed immediately by the criterion test for the second learning task. Records were kept of time requirements for each subject on each of the treatments and tests.

All research hypotheses were tested at the .05 level of statistical significance.

Hypothesis one: There is no difference in achievement among groups receiving the experimental treatments as measured by the initial learning test for the first learning task administered immediately following the treatments.

No statistically significant differences were found among the means of groups receiving the three experimental treatments: textbook, linear program, and branching program. However, the adjusted means of all three groups receiving the experimental treatments were significantly higher than the mean of the control group.

Hypothesis two: There is no difference in retention among groups receiving the experimental treatments as measured by the retention tests administered 10 days after instruction on the first learning task.

Again, there were no statistically significant differences among the means of the groups which received the three experimental treatments, but the adjusted means of these three groups were significantly above the adjusted mean of the control group.

Hypothesis three: There is no difference in achievement among groups receiving the textbook assignment for the second learning task as measured by the initial learning test for that task administered immediately following the treatment.

No statistically significant differences were obtained among the adjusted mean test scores of the groups, therefore the null hypothesis was retained.

Hypothesis four: There is no difference in achievement among levels as measured by the initial learning test for the first learning task administered immediately following the experimental treatment.

The results of the statistical analysis indicated that the adjusted means of the seventh grade and the eighth grade levels were not significantly different. However, the adjusted mean of the ninth grade level was significantly higher than the adjusted means of the seventh grade level and of the eighth grade level.

Hypothesis five: There is no difference in retention among levels as measured by the retention test administered 10 days after instruction on the first learning task.

Again, the adjusted mean of the ninth grade level was significantly higher than the adjusted means of the seventh and eighth grade levels, but there were no significant differences between the adjusted means of the seventh grade level and the eighth grade level.

Hypothesis six: There is no difference in achievement among levels receiving the textbook treatment for the second learning task as measured by the initial learning test for that task administered immediately following the treatment.

The adjusted mean of the ninth grade level was again significantly higher than the adjusted means of the seventh grade level and the eighth grade level. No significant differences were obtained between the adjusted means of the seventh grade level and the eighth grade level.

Hypothesis seven: There is no difference in time required to complete the first experimental treatment among groups receiving the textbook treatment, the linear program, and the branching program.

The statistical analysis indicated that each treatment mean was significantly different from all other treatment means. The group completing the linear program had the highest mean time requirement, 34.6 minutes, while the group completing the branching program required 31.4 minutes, and the group completing the textbook selection required 24.7 minutes.

Hypothesis eight: There is no difference in time required to complete the experimental treatment for the first learning task among levels receiving the experimental treatment.

The test of the hypothesis indicated that the mean time was significantly less for the seventh grade level than for the eighth and ninth grade levels. There were no significant differences in mean time on this experimental treatment between the eighth and ninth grade levels.

Hypothesis nine: There is no interaction among experimental treatments and levels in terms of initial learning or retention on the first learning task, initial learning on the second learning task, and time required to complete the first treatment.

Only one of the variance ratios for interaction effect attained statistical significance. The treatments x level effect in the analysis of covariance of scores of the first test was statistically significant. The analysis indicated that this interaction effect could be attributed to the fact that the adjusted mean score of the seventh grade group which had received the branching program was not significantly higher than the adjusted mean scores of the three levels of the control group.

In addition, the adjusted mean scores of all experimental groups in grade eight were significantly higher than the adjusted mean score of that seventh grade group, but not higher than the adjusted means of the seventh grade groups which received the textbook or the linear program. There is some doubt that much practical importance may be attributed to this isolated instance of interaction.

Generalizations from the findings of this study must be limited to the population, treatments, tests, and conditions used in the experiment. No attempt has been made to provide accurate information about the relative quality of any experimental treatment, either in comparison with other treatments from its population, or in comparison with other experimental treatments.

Similarly, no information has been obtained in this study regarding the effectiveness of programed instruction as a supplement to textbooks or other types of instructional presentation. The relatively short period of time required for the experimental treatments imposes severe limitations upon interpretation, as well as the fact that the experimental subjects were treated and tested in an unannounced, relatively artificial, large group situation.

Similarly no knowledge of results on tests was provided to the subjects, who had little prior experience with the two forms of programed instruction. The learning tasks both utilized factual content, and it would be difficult to generalize beyond this type of content.

Where similar situations prevail, the following conclusions could be inferred:

1. The three experimental treatments, textbook, linear program, and branching program, are equally effective in terms of initial learning and retention.
2. The three experimental treatments used for the first learning task did not affect subsequent learning of an independent learning task from a textbook presentation.
3. Students in the ninth grade level achieved higher scores than students in grade seven and eight. However, the achievement levels in grades seven and eight did not differ significantly.
4. The linear program required more time for completion than either the branching program or the textbook selection. The branching program required more time than the textbook selection.
5. Seventh grade subjects spent less time on the experimental treatments than the eighth and ninth grade subjects. No differences in time requirements were noted between grades eight and nine.

6. All experimental treatments led to significant achievements in comparison to the achievement of an uninstructed control group.

It would be highly desirable if studies could be designed to compare the effectiveness of programed instruction and textbook instruction over a much longer period of time. It would also be helpful if research studies were designed to investigate the effects of variations in specific variables in both programed instruction and in textbook instruction.

Studies designed to evaluate the effectiveness of textbook assignments and/or assignments using programed instruction as a supplement to classroom instruction would be most valuable. In addition, research should be conducted to investigate ways written information and programed instruction may be used for the acquisition of information needed for manipulative activities in the industrial education laboratory.

Since subjects in all three experimental treatment groups were able to achieve a substantial degree of learning of a relatively difficult learning task within a comparatively short time, it would appear that industrial education students could be expected to acquire information from independent study assignments, either from textbooks or from programed instruction. Since the subjects completing the three experimental treatments did not differ significantly in achievement on the criterion tests, the differences in time required by the experimental treatments assume some educational importance.

On the basis of time required for a given level of achievement, the textbook selection used in this study required 24 percent less time than the branching program and 29 percent less time than the linear program. If this result is substantiated by further research evidence based upon a broad sample of textbooks and programed instruction presentations of a variety of learning tasks, it would imply that textbooks be used in preference to programed instruction for the most efficient use of study time.

Unless research evidence is obtained which would contradict the findings of this study, it would appear that industrial educators could continue and expand the use of textbooks for independent study assignments. This implication would seem to apply until such time as programed instruction is shown to be more effective or more efficient than textbook instruction.

The implication would not apply if programed instruction becomes more convenient and/or less expensive than textbook instruction. At the present, economic factors and convenience in use would seem to favor the textbook rather than programed instruction. Once again, a word of caution: the programs used in this experiment were developed by the experimenter, a novice at the art of programing. Therefore, it would be extremely hazardous to attempt to generalize these findings to all programed instruction in industrial education.

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THE USE OF PROGRAMED MATERIALS IN TEACHING TECHNICAL INFORMATION

PROGRAMED instruction has become a factor in education today as a result of two problems. (1) An innate U. S. human tendency to be dissatisfied with conditions as they are, resulting in a constant attempt to improve those conditions, (2) and the press of time and subject matter content on the instructional programs of today.

The study I will discuss today came into focus as a direct result of point number two, available classroom time and subject matter content. The problem was at least partially resolved through an investigation of teaching procedures to find where improvements could be made.

The study had three purposes: (1) to determine which of four teaching techniques utilized in the study indicated the most efficient learning based on the scores of a pre-test and a post-test, (2) to determine if the most efficient technique from the point of view of amount learned made more effective use of student class time than the other three techniques, (3) to make recommendations for a modified schedule based on these findings which would expand the capacity of the existing laboratories without enlarging the class size or lengthening the instruction day or week.

Before going any further I would like to briefly discuss "programed materials." The usual definition of a "program" is a sequence of carefully constructed items leading the student to mastery of a subject. In many cases this sequence would be run through some type of teaching machine. My interpretation is less restricted than this one. I submit that anyone teaching a class from a written course outline and syllabus is using a form of programed instruction. The item that makes the program effective is the careful organization and sequencing of information materials.

The wood identification unit of the machine woodworking class was used for the experimental phase of this study. This unit has been taught along the following traditional lines. Two strips of samples containing the woods to be studied were placed on each workbench. Each sample was numbered to facilitate initial identification by the student as the instructor discussed each piece. A blank identification chart was issued to each student to be filled in as the sample; its characteristics and uses were discussed and noted on the chalkboard by the instructor. This procedure will be referred to hereafter as the traditional method, or Method "A."

Four variations in method were used. In Method "A" the traditional method was used, with the addition of the Department of Agriculture bulletin, *Woods—Colors and Kinds,* which contains many good color photographs and descriptions of the more common United States woods. A copy was issued to each student.

For Method "B" each student was given a *completed* identification chart and a copy of *Woods—Colors and Kinds.* Each student had available at his bench identified samples of the different woods to refer to while the instructor pointed out and discussed the identifying characteristics of each species on a colored slide projection.

In Method "C" again each student was issued a completed identification sheet, the pamphlet, *Woods—Colors and Kinds.* He was also given a copy of the lecture outline prepared for Methods "A" and "B." The Automatic Comparator, a teaching device developed by Dr. Ruehl of the Stout electronics department, was used in conjunction with six different sets of wood samples for self-teaching by the students.

The primary responsibility of the instructor was to hand out the materials and explain the use of the machine. The six practice sets contained woods selected from the ten woods being studied. In some cases a practice set included duplicates of woods such as maple and birch that were difficult to identify. This procedure reduced the possibility of identification by elimination and gave additional practice where most needed.

Student study practice was done outside of regular class time. This machine required that each of the four characteristics being studied be correctly identified before a green "OK" light would go on. If one of the characteristics was not properly selected nothing happened and the student then had to go through a re-evaluation to see where he had errored and then make corrections.

For Method "D" each student was given a *blank* identification sheet, a copy of the lecture prepared for Methods "A" and "B," and the *Woods—Colors and Kinds* pamphlet. Six boxes of samples containing different assortments of the ten woods were set up for use by the students for study during their unscheduled time. Each box contained a card keyed to that particular box for confirmation of all identification characteristics.

In addition to the specific items listed for each method, all students were supplied with a sheet of photographic reproductions of non-porous, diffuse porous, and ring porous woods on transverse sections, and a sheet giving the nomenclature and relationship of parts of a tree.

In effect the first two methods were teacher-directed with the bulk of studies taking place in class. By contrast, Methods "C" and "D" required student-initiated study. The traditional method took 150 minutes of class time. Method "B" slides consumed 40 minutes of class time. With Methods "C" (Automatic Comparator) and "D" (samples boxes), only 10 minutes of class time were needed to check the students out in the use of the instructional materials involved. The objective here was that a definite transferral of learning responsibility be made from the teacher to the student from Method "A" to Method "D." Basically the same printed materials were used for each presentation. The difference was in how they were presented and used by the students.

The ten woods—pine, fir, mahogany, walnut, birch, ash, oak, elm, cherry, and maple—were selected because they are generally available and widely used in industrial arts and commercial work.

The staff of the Stout State College woodworking department was used as a panel of experts in approving the appropriateness of test forms, testing procedures, and test samples. It was through the action of this group that the four characteristics for identification were determined.

Color, of course, is an outstanding characteristic for identification. However, it is not an identifiable characteristic under the procedure followed in this study. The panel of experts decided that if a student could differentiate between non-porous, diffuse porous, and ring porous conditions in selected samples, he could, by correlating the above two items with color, identify the species of the sample and catalog it according to its technical classification, i.e., hardwood or softwood. The ability to identify these characteristics was the basis for evaluating the effectiveness of the different teaching procedures.

The general hypothesis tested was that there was no difference in the amount learned via the four teaching techniques used in the study as measured by the mean score scale of the Kruskal-Wallis One-way Analysis of Variance by Rank Test.

The information gathered was further analyzed through twelve sub-hypotheses in which the eight class sections were separated into upper-quartile, inter-quartile, and lower-quartile groups and independently compared with the control groups of Method "A," the traditional method. The Mann-Whitney U Test was used for this comparison.

In all cases the analysis was made using the net gain difference between the pre-test and post-test scores.

Non-parametric statistics were used for this study because the scores under analysis were not drawn from a normally distributed population and the group sizes were not constant having a range of 12-22 within the eight class sections used in the study.

Very briefly, the study indicated there was no statistically significant difference in the learning results of the four methods of teaching wood identification.

For the analysis of the sub-hypotheses the traditional Method "A" was considered the constant with Methods "B," "C," and "D" used as the variables. The result of Methods "B," "C," and "D" were independently compared with the results of Method "A" to determine their relative effectiveness.

The results of this comparison indicated that the same instructional materials can be presented several ways using varying amounts of time, and still achieve results having no statistically significant difference. The same condition held true in the independent comparison of the four methods when divided into quartile groups on the basis of the pre-test scores. This analysis was made to determine if a relationship existed between the effectiveness of a teaching method and pre-existing knowledge of a student as indicated by the pre-test score. No difference was indicated.

This study confirms the results of several other studies in two respects: (1) it shows that properly organized instructional materials *can* be presented in several different ways and produce results showing no statistically significant difference, and (2) that some instructional procedures need less class time than others for presentation of the information involved.

What implications do studies of this type have for technical education? On the premise that there are many implications for our programs, another question comes to mind. What place does programed instruction have in technical education? If the old saw about variety being the spice of life holds any truth, then there is a definite place for this kind of instruction in our program. However, we must continually work for balance.

Education seems to have much in common with a pendulum gone berserk. There is no middle ground. It continually takes off on one extreme or another depending on the national emergency of the moment, the temper of our critics, or the pet project of a vocal group of educators. There was much good in the "education for democracy" movement of a few years back, the "life adjustment" emphasis has much in its favor, likewise the current furor about the value of math, science, and the foreign languages will leave its mark. To come closer to home we have only to reflect on the impact of the Russian and Sloyd systems of teaching the mechanic arts on our programs.

There has been evidence of this same lack of balance in the use of programed instruction. Teachers wailing that they were going to be replaced by machines. Economy-minded administrators trying to do just that. Attempts to put full courses into program form.

As I view programed teaching, I see several distinct uses in industrial education. The primary reason for using it in many programs is that it adds some variety and some spice to the instructional program. But as you gourmets all know, a spice is added with discretion, a dash, or a pinch, to make even more attractive, pleasing flavors already present in the dish.

Programed instruction reinforces the individual instruction concept of teaching that is so strong a part of our program. And it does this without requiring the teacher's immediate presence. Recognizing that learning occurs individually, the fundamental objective of education is to create an environment which will enhance this process. As a direct correlation of independence in learning, it is apparent that, when the responsibility for scholarship is placed upon the student rather than upon the teacher, the stage is set for education in its true sense. With focus on the student, it is essential to recognize, and provide for, individual rates of learning and accomplishment. This programed instruction helps to do.

As my study helps to point out, programed teaching can provide more available classroom time by enabling the student to study outside of class, materials that were previously spoon-fed to him by the teacher in class. Reflect on the possibilities! Think of all the technical related information that you would like to cover in your classes, but are not because you have run out of time!

Programed instruction, as I have defined it, has a great future in education. Industrial education can profit from it as much as any other field of education—through proper use.

A group to which I belong has as one of its tenets—"If there is anything virtuous, lovely, or of good report, or praiseworthy, we seek after these things."

We will succeed in making our programs more meaningful, and successful as we utilize all teaching processes that are praiseworthy or of good report. Programed teaching qualifies.

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TEACHING MANIPULATIVE OPERATIONS WITH PROGRAMED MATERIALS

How to teach manipulative operations to relatively large groups of students has always been a problem. The problem has become more acute as industrial arts has moved toward the philosophy of individual projects and the comprehensive general shop.

In recent years, programed materials have been developed that appear to have advantages over some of our present methods of teaching verbal materials. Programed materials offer advantages over the lecture in that they present the same material to everyone, as fast or as slow as the individual student needs it. Absenteeism and preparation time for the teacher are not problems.

One of the standard definitions of programed instruction is that it presents information in small units. The student is tested over each small unit, knows immediately whether his response was correct, and proceeds at his own pace. These are all conditions that are supposed to have value in helping the student learn better.

Do our demonstrations meet these conditions? In a well prepared demonstration, the instruction is presented in carefully prepared units which are the steps in the operation. But the test, which is correct student performance, does not come after each step, but after the entire demonstration and in many cases not for several weeks. In a demonstration the instruction isn't presented at the optimum rate for each student, but usually at a rate suited to the average student.

It appears that there would be definite advantages in putting demonstrations in printed form, but since demonstrations involve both telling and showing, the development of these materials presents a number of problems. I have been working with the problem of putting demonstrations in printed form. The materials might be briefly described as printed materials in book form which "tell" and "show" how to perform an operation through a carefully sequenced set of photographs and written instructions. The results of my experiences and the implications these materials have to industrial arts instruction are the object of this presentation.

In an attempt to ascertain the effectiveness of this type of programed materials, an experiment was set up to compare them with demonstrations when used as a means of initial instruction. Seventh grade industrial arts students were taught four metalworking operations which were completely new to them: (1) how to make a sand foundry mold; (2) how to enamel copper; (3) how to drill a clearance hole for a machine screw and counterbore it for the screw head; and (4) how to cut internal threads with a tap. Great care was taken to see that both methods of presentation were equally well prepared.

Because this was a basic study to ascertain the capabilities of the new materials, the experiment was conducted under highly controlled conditions in order to get accurate records of time, retention of instruction, and student performance.

With both methods of presentation, only four students at a time received instruction and performed the operations. In neither case could they see each other perform or help each other. The students receiving instruction by demonstration performed the operation immediately after the demonstration and the students receiving instruction by book performed as they read. The students knew they would be tested over the material and that the projects would be graded, but they did not know they were participating in an experiment.

In order for programed materials to overcome some of the disadvantages of demonstrations they should be able to produce results at least equal to demonstrations while exhibiting no serious faults. The following six areas seemed to represent the important points for comparison of the two methods of presentation.

1. How well do students perform the operations as reflected in the quality of the project? It might be possible that when performance is from a series of photographs and written instructions instead of after watching the skilled performance of a teacher, the students would produce poor quality work.

2. How well do students remember the terminology and steps of procedure? It is conceivable that they could perform the operation the first time with a book but would be completely unable to perform the operation again without a book to follow.

3. How much time does it take to receive instruction and perform the operations? If it takes a considerable amount of time for the student to study the material and experiment in order to perform the operation, then the printed materials would be of very little value in the shop.

4. What is the relative amount of time and effort required of the teacher for both methods of presentation? The inability of the instructor to present adequate instruction to relatively large groups of students was one

of the main reasons for attempting the development of these materials. If the materials do not reduce the total time required by the teacher for group instruction and individual assistance, then one of the main advantages of programing the material would be lost.

5. Because the use of printed instructional material involves interpretation and transfer, it is conceivable that only a very intelligent individual could perform operations satisfactorily with this type of instruction. In an attempt to clarify this point, the students were divided by intelligence test scores into upper and lower groups and the student performance resulting from the two methods of presentation was compared in each of the groups.

6. Since the use of printed material is dependent upon the reading ability of the students, the students were divided into upper and lower groups by reading test scores and the performance resulting from the two methods of presenting instruction was again compared in each group to get an indication of the effect of reading level on the effectiveness of the printed materials.

The average project-quality scores from both methods of presentation were nearly identical, indicating that there was no appreciable difference in quality of performance between the two methods of presentation.

On tests given immediately after performance and a week later, the students receiving instruction by programed materials made slightly higher scores, but the difference was not statistically significant.

The average time required by students to receive instruction and perform the operations was about 7 percent longer when instruction was presented by programed materials than when it was presented by demonstrations.

As an indication of ease of teaching, 69 percent more individual assistance was required when instruction was presented by demonstration than when presented by programed materials, and if each demonstration had been given once in each class, instruction presented by demonstration would have required an average of approximately 12 more minutes teacher time per class period.

As an indication of the effect of intelligence, students in the upper half of the group (106 to 130 IQ) did not exhibit any significant differences between the two methods of presentation in retention, project quality, or time, but when instruction was presented by demonstration, 76 percent more individual instruction was required during performance.

Students in the lower group (85 to 105 IQ) had essentially the same project quality, slightly better test scores, but required about 12 percent more time for programed materials, and again 64 percent more individual assistance during performance was required when the instruction was presented by demonstration.

As an indication of the effect of reading level on the effectiveness of the programed materials, students in the upper reading level (8.5 to 12 grade level) and lower reading level (5.0 to 8.5 grade level) compared nearly the same as comparisons made by intelligence.

Insofar as these findings may be true of other operations and of actual use in the shop, it appears that for students of above average intelligence and reading level, the two methods of presentation may be expected to produce approximately the same achievement in terms of knowledge retained, project quality, and student time required. Programed materials may be expected to require significantly less teacher time and result in significantly less student errors.

For students of average or slightly below average intelligence and reading ability, the two methods of presentation may be expected to produce approximately the same project quality, while programed materials may be expected to result in slightly better retention and significantly less teacher time and student errors, but require slightly more student time.

It appears then that the programed materials may be able to produce results at least as good as demonstrations with far less time and energy on the part of the teacher. The amount of time required by the slower students appears to be the main disadvantage of the programed materials.

But it must be remembered that this comparison was made with student performance immediately after a well-prepared demonstration. In an actual shop situation, this apparent disadvantage of requiring extra time will likely disappear if not even be reversed.

Since the study reported was not conducted under the usual shop conditions, some general observations of limited use of programed material as a part of regular shop activity will be reported.

In the case of some of our other instructional material such as operation sheets, it is sometimes difficult to get students to get the sheets out and use them. Students did not object to using the programed materials and appeared to be happy to have them.

In the study, students had to get all of their assistance from the instructor, while in the usual shop situation they may assist each other. This should cut down on the number of times a student needs assistance from the teacher regardless of the method of presentation, so the ratio would probably remain the same.

When a student does need assistance, the printed materials have an advantage whether the assistance is given by the teacher or other students. If the student is following a book, most of the assistance is a matter of interpreting what is printed or of pointing out where the error was made.

Some of the manipulative operations performed in industrial arts classes are performed only as a means of learning through concrete experience. We are not interested in a boy remembering the exact steps of procedure, but in successful completion during the first trial. Programed materials seem to be well suited to this type of instruction.

Students who have had no exposure to the tools or processes seem to be able to perform the operations with less difficulty than after a demonstration. Some operations are repeated a number of times and it is considered desirable for students to remember them. The study reported that, as measured by tests, the students do remember terminology and procedure at least as well or better from using programed instruction than after watching demonstrations.

General observation in the shop of repeated foundry work confirms the finding that students do remember what they have done. It was also observed that when left completely on their own students will depend less and less on the book as they repeat the operation. In general, the student studies the book carefully the first time through the operation, and during his second performance he mainly looks at the pictures, and when the operation is repeated again he may perform several steps without looking at the book and then look up what he needs when he is in doubt.

It appears as one might expect that the brighter students would learn to do without the book faster than the slow students, and that the length of the intervals between performances would also affect the number of performances needed to perform without a book.

The question of the use of instruction books and safety is a point that must be considered. You obviously would not want to let a student perform an operation by reading a book when the consequences of an error would be great. The book could give instructions on how to set up a machine for an operation and then direct the student to have the instructor check it and assist in the actual performance. If the number of students wearing face shields while drilling holes in metal with a drill press is any indication of how effective the safety instruction in programed materials is, then programed materials are more successful than a reminder during a demonstration.

It appears that programed materials have the potential of providing effective instruction at a large saving of time to the teacher. This, of course, has implications for industrial arts teachers.

It should free some of the teacher's time so he can do a better job with some of his other teaching responsibilities such as planning and problem solving. In other words, it would enable him to do a better job of what he is already supposed to be doing.

It should enable the better students to proceed ahead of the rest of the class with very little assistance from the teacher, and even make it possible for students to go into areas not normally taught in a given course.

In cutting threads, even though they had not seen a demonstration and had never used a tap or tap wrench, the better students were able to read a tap drill chart and cut internal threads with very little assistance. Eleven percent of the students required no assistance, 37 percent required assistance only once, and 26 percent required assistance only two times, making a total of 74 percent of the students that required assistance two times or less.

In foundry, even though they had never seen a demonstration, had never seen anyone else perform the operation, and had never seen any of the equipment before, 65 percent of the students required assistance three times or less. The upper 10 percent of the students needed assistance on an average of one time for each operation. It is possible in the shop that they might assist each other and reduce the amount of assistance required from the teacher even further.

The materials should work well in enrichment programs where a student with little tool experience needs only to successfully perform the operation once in order to construct a project.

We do not know that the way programed materials were used in the study is the best way to use them. It may be that the optimum rate of learning would be accomplished by the teacher demonstrating the operation to the whole class while they follow along in programed instruction books. There is some indication that a demonstration followed by the use of instruction books during performance reduces performance time considerably and reduces the error rate. It might be possible that this combination would offer an overall saving of time to both the student and the teacher.

Because of the lapse of time between demonstrations and performances, many students are not sure of themselves and they ask the teacher many questions. They develop a habit of asking the teacher without even trying to figure out the answer themselves. Perhaps students would develop more independent work habits if they had programed materials to follow to serve as a good basis for trying to figure things out on their own.

From very limited experience with programed materials for teaching there are many things we do not yet know about them and there are a number of problems in developing these materials.

It is not known how well the materials will work with other operations, especially those that require a high degree of coordination such as wood turning, metal spinning, and truing the edge of a board with a jack plane.

Variations in equipment present some problems. If the equipment differs too much from the equipment shown in the books, it might reduce the effectiveness of the materials. It appears that small variations in equipment will not seriously affect student performance.

The development of programed materials is time consuming and is not an easy task. The organization, writing, and photographs are all critical. A high rate of success in performance is necessary or the students will not want to use the materials. The materials must be written and re-written, photographs taken, a copy made up for trial, and corrections made in the photographs and written material until students can follow them with a high rate of success.

Showing motion with still photographs is a problem in developing the materials. The problem seems to have been overcome fairly well in the four operations involved in the study. How well this can be done where more complex movement is involved, such as in wood turning and metal spinning, has not been ascertained.

The last point I wish to make is that programed materials for teaching manipulative operations will not replace the teacher. The materials require that students read, interpret, and apply what is presented. Each student must judge whether what he has done is the same as is presented in the book and whether the quality of his work is as good as it should be. Although the study indicated that students could perform some operations without a demonstration, I feel that a skillfully executed demonstration by the teacher may serve as an inspiration and goal to the students.

Programed materials should be thought of as an aid to instruction that will benefit both the student and the teacher. They should free the teacher from much routine instruction and at the same time save the student much time and loss of interest from waiting for help from the teacher.

The teacher is still needed to diagnose learning and performance difficulties and to work with complex areas such as problem solving. From what is known about this type of programed material at the present time, it appears that it will have the capability of giving the teacher a big assist in his complex job of teaching industrial arts.

LEIGH A. ROEHR
General Electric Company
Nela Park
Cleveland, Ohio

LIGHTING FOR THE INDUSTRIAL ARTS CLASSROOM

IN his discussion, Leigh A. Roehr stressed the importance of an awareness of good lighting and the contribution that lighting makes in creating a good teaching and learning environment.

With slides, Mr. Roehr showed that in adequately lighting the industrial arts classroom more than one lighting system is needed.

One illustration showed a classroom in the high school at Kimberly, Wisconsin, that used three rows of four-lamp fixtures with 40-watt fluorescent lamps to provide 150 footcandles of good quality illumination. The only window in the room is a nine foot high, four foot wide vertical window at the rear. The students face away from the window so that none of them are subjected to the direct glare. The room also has a chalkboard lighting unit, which makes the writing on the board easier to see.

The mechanical drawing room in the school is lighted to over 100 footcandles with well-shielded fluorescent luminaires. The drafting tables are located at a 45-degree angle to minimize shadows from T-squares, triangles, etc.

Another way to reduce shadows is the use of fluorescent fixtures running in both directions, crosswise and lengthwise. These are four-lamp units. The lighting level is over 200 footcandles.

A metal working shop in a California school uses slimline lamps in continuous rows of fluorescent fixtures to provide a higher level of good lighting. There are many times that supplementary lighting is needed even in areas that have a good quantity of general illumination.

A welder can be illuminated with a cluster of three 500-watt PAR 64 spot lamps to provide 10,000 footcandles. This is a little more than the sun provides out of doors on a bright summer day. The welder's mask can be left down and excellent vision maintained before and during the striking of the arc. Once the arc is struck a foot-operated switch turns the spotlights off.

Edward A. Campbell
Head of Secondary Education
Huntington College, Huntington, Indiana

THE KEY TO A SAFE LEARNING ENVIRONMENT

THE key to a safe learning environment is the teacher. The teacher controls the laboratory environment, analyzes this environment, decides what the instructional program will embrace, and is the foundation of environmental safety.

We must guarantee the student reasonable safety, a competent professional educator as a teacher, and the finest learning environment.

If we are to fulfill our legal as well as moral responsibility to our students, the learning environment must be made as safe as possible. Let us focus our attention on tangible items which revolve around the structure, physical layout, visual, thermal and acoustical atmosphere and the miscellaneous items of a general nature which contribute to the tangible aspects of the learning environment.

Structural safety is extremely important. Floors, walls, and roofs must be structurally sound and capable of sustaining the loads and demands placed upon them by equipment, storage, weather, etc.

The structure must facilitate fire safety. This necessitates the complete utilization of non-flammable materials in construction, adequate exits and access to these exits, and means to contain a fire until the occupants can escape and the fire department arrives.

The physical layout of the laboratory must facilitate learning, but it also must contribute to student safety. In order to minimize accident potential in the laboratory layout, the administrator designing, arranging, and managing a shop program should engineer the facilities of new laboratories and analyze present facilities to pinpoint and abate hazard.

Unless your students are totally blind, sight is basic for learning and safety. The visual atmosphere of the laboratory will eliminate accidents by the reduction of eyestrain and fatigue. It will control the psychological atmosphere by creating comfort, security, and well-being. It will also increase learning and safety by exerting a positive influence.

If the thermal atmosphere is to fulfill its obligation it must maintain a comfortable temperature regardless of the exterior conditions. It must eliminate stuffiness and contaminated air. It must also present an atmosphere conducive to maximum safety and learning. The spread of respiratory diseases must also be prevented.

Sound control is the next area to be considered in the learning environment. If the laboratory is to promote learning and safety, three aspects of sound control must be considered.

The first is communication. All signaling devices as well as the instructor's voice must be heard. The second is the control or elimination of distracting sounds.

The last is transmission. Sounds should not be conducted to other areas or rooms due to the resulting distractions, etc.

Now let's take all the remaining physical environmental factors and group them under a miscellaneous category. These include the site. The exterior of the laboratory can present many hazards in the form of cliffs, ravines, lakes, driveways, loading docks, ice and snow.

Plumbing must be considered. One naturally assumes that drinking water is not contaminated. Sewage is adequately disposed of. Adequate water is available for fire fighting. All acid sinks will handle acid. Steam lines will not rupture.

Excessive hazards created by boiler rooms, flammable storage, etc., should be isolated or effectively controlled.

Electrical service should conform to the latest Underwriters code as well as local codes.

Custodial service should be effective and efficient to insure good housekeeping and a safe sanitary learning environment.

Now that I have briefly surveyed the major physical environmental factors of the laboratory, let us focus our attention on the intangibles which contribute to the general laboratory environment.

These intangibles include the social and psychological environment, instruction, and administration.

SANDALS FOR STUDENTS: AN EDUCATIONAL DO-IT-TOGETHER PROJECT FOR AMERICAN AND LIBERIAN STUDENTS

MAURICE FLAGG, *Editor*
American Red Cross News and Journal
American National Red Cross
Washington, D.C.

THE RED CROSS AND THE PROJECT

THE request, as we originally received it from the Liberian Red Cross, was a simple one. The Liberian National Department of Public Health and the National Red Cross Society had been discussing ways of cutting down the incidence of hookworm, particularly in the interior of the country.

The problem was not lack of footwear in the country. The problem was to popularize the regular wearing of simple foot covering—not an easy thing to do in a hot country where it's a perfectly natural thing to walk about barefoot.

It had occurred to the Red Cross and public health people in Liberia that if they could obtain a good quantity of sandals, a distribution of these to school children might help. The Liberian Red Cross asked us whether our youth membership might be interested in furnishing the sandals.

It was a quite routine request, actually, one that could have been filled, even overfilled, by any one of our large chapters. It could have been done in almost no time in one of two ways—by our young people contributing money to buy sandals in carload lots, or by shop classes making the sandals as a Red Cross project, following a standard pattern and using durable materials; as a matter of fact, one of our large chapters did offer to conduct the entire project in the latter fashion.

We decided, however, not to carry out the project in the easy way, for reasons that are fundamental in the service philosophy and policy of the Red Cross.

The Red Cross is perhaps best known for its work in aiding disaster victims. I cite that work as an example here without, I hope, suggesting that the Liberian project had any connotation of disaster.

Some common principles, though, underlie both kinds of work. We help disaster victims for any number of immediate reasons—in order to help speed the work of cleaning up a disaster mess, to help bind up injuries, to get families together again, to put roofs over the heads of families unable through their own resources to restore their shelter.

The basic reason for doing these things on behalf of the American people is to assure that every disaster victim is restored as speedily as possible to self-sufficiency.

We involve the individual and family in the planning of their recovery and make the recovery as much a thing of self-help as is possible. Our work essentially, is a matter of human dignity, its promotion, maintenance, and restoration.

It is 180 degrees removed from the common understanding of charity. It is a practical business of both restoring individuals and families in their time of need brought about by causes beyond their control, and assuring that they will be able to help others when and if *that* need arises.

No doubt, you now glimpse some of the reasons we asked Industrial Arts classes in the U.S. to research, think through, and plan a simple sandals-making process that Liberian students might themselves carry out, using tools and materials locally available, in order to make simple footwear for themselves and their families.

The phase of this project carried out in American schools was developed in order to afford American students a practical project experience contributing to human need in three substantial ways: by developing a process that would serve the real need of others; by contributing to students' education and understanding of the world in which they live; and by contributing an exercise capable of being assimilated into the school curriculum.

The community, too, participated in the experience, through its Red Cross chapter. You see here the vital network of relationships through which we work in order to give a project maximum value at every stage.

The phase of the project developed for Liberia was planned to help Liberian schools and students learn the assembly-line process and rationalization of work through direct participation and the use of readily available materials. An understanding of the assembly-line system, we hoped, would prove useful to Liberian students as they prepared themselves for modern vocations and would also impart realization of the practical good that may result from people working together to accomplish a needed job.

This last value, in *its* turn, we hope, will in the long run be useful both to the Liberian nation and the Liberian Red Cross in their efforts to surmount the pressing social, and health problems that naturally exist in tropical nations and whose challenge is added to daily by the struggle of the developing nations to become full producing partners in the mid-twentieth century world.

In concluding these brief remarks, I should like to note the conclusive evidence of the Liberian project's success. That evidence is this; we are no longer conducting the project. It is finished history, so far as we are concerned.

It continues now as a Liberian Red Cross and school project. As it were, we worked ourselves out of a job in this instance, and we couldn't feel more pleased with ourselves and with the Liberian people.

But there will be similar projects in the future that we will approach in the same way. Some of you may be involved with your class and schools in them. We look forward to working with you.

William H. Dyson
Swanson Junior High School
Arlington, Virginia

MAKING SANDALS IN THE ARLINGTON SCHOOLS

"Can a Red Cross project be made an integral part of the Industrial Arts curriculum?" This question was raised before the Industrial Arts teachers in an Arlington county in-service meeting in January 1963.

Instead of requesting that teachers ask their students for completed sandals ready to wear, Mr. Terry Townsend of the Office of Educational Relations, asked for partially completed sandals with materials, tools, jigs and fixtures, along with instructions for producing the sandals on a line production basis.

Industrial Arts teachers from the junior high schools met to determine whether the project could be fitted into the curriculum, whether it offered suitable learning experiences, and whether it was in the realm of their students' capabilities.

The teachers studied their "Industrial Arts Curriculum Guide" which had sections on problem solving, research and experimentation, and mass or line production techniques. They concluded that the sandals project would help in reaching all these goals as well as offer motivation.

They decided to present the program to their students to see if they would accept it. In each case, at least one class voted to make the sandals, or at least, to try. Of the six classes, five produced acceptable sandals which could be made on a line production basis.

As the students began work on the sandals, the local Red Cross took over sponsorship so that the project could follow proper channels. The local Director of Educational Relations called a meeting of the school administration Red Cross representative, principals, teacher sponsors and presidents of school Red Cross councils. The plans were again explained and this group officially accepted it as a county project. Individual school Red Cross clubs still had to pass on the plan.

As a climax to the project, the council planned and presented an assembly program for the entire student body on Liberia and on the sandals project. A film was shown depicting life in Liberia and the technological advancements of that country in recent years.

Mrs. Laura Tucker, cultural attache and student adviser of the Liberian Embassy in Washington, talked to the students about her country.

Special guests for the assembly included officials of the National Red Cross, Peace Corps representatives, school administration officials and members of the press. Most departments and groups in the school helped in making the sandals project a success.

The student council made a collection of important facts about Swanson Junior High school and combined them with pictures of the school and school activities into a scrapbook so that Liberian students could see what the Swanson school was like and learn something about the people who had worked on the sandals project.

After the Industrial Arts students heard the introduction of the sandals project given by their instructor, members of one class voted to accept the challenge and to try to produce the sandals. Two students began work on research. Through information found in the social studies classroom and through an interview with Mrs. Tucker, they learned that Liberia possesses large deposits of iron ore, has enormous forests of timber, and produces a large amount of the world's supply of natural rubber.

They also learned that there are more than 15,000 motor vehicles in Liberia. From the embassy, they learned that animals from which to get leather are scarce because of the tsetse fly which kills domestic animals.

In a later class discussion where this information was reported, it was immediately decided that neither iron nor wood would be serviceable. Leather probably would be scarce and expensive. Rubber seemed a very good choice.

The question arose as to whether Firestone might furnish rubber. Old rubber tires are plentiful since Liberia has quite a large number of motor vehicles. The embassy assured us that any need for old tires would be met either in the villages or through the Firestone Rubber company. Committees in each school began working with old tires.

Hours were spent trying to find a way to cut the rubber. Metal rings which were hard to cut were found around the edges of the tires. One student discovered how to cut the rims away from the tires without having to cut through them.

As interest built up, the students were shown a film entitled "A Local Production" which showed a class of former Arlington students working on a line production job. The filmed class had organized a corporation with officers and committees.

After they saw the film, the present class spent some time thinking of names for its company. They decided on the name "Ye Olde Sandals Shoppe." They elected a president, vice president, and secretary. They, also, appointed a designing committee, and engineering committee, a production committee and an inspection committee.

The designing committee designed a sandal. The first few pairs were very rough and rectangular in shape. Most of the members of the class worked on the design. Finally, one boy used his foot for a pattern and marked off a shape of it on the rubber. He used a utility knife to cut it out. The group seemed very pleased with the new shape.

The next job of this committee was to find a way to hold the sandal on the foot. Several days were spent trying to find a suitable, comfortable way to bring the strap up between the toes. At first, they tried to use parts of the tire cut to serve as a strap. This proved bulky and uncomfortable. Next, they tried strips of the inner tube between the toes. This still seemed uncomfortable. Finally, the idea of punching four holes in the edge of the sandal and running strips to the inner tube through the holes to tie around the foot was tried. This seemed to work and was accepted.

The engineering committee had as its job the preparing of jigs and fixtures. Some of the same students who had worked on the designing worked with this committee on making the jigs.

Many ways were tried in an effort to find a fast, efficient way of cutting the pieces of rubber the same size and shape. After much deliberation, the committee cut for each jig, one piece of quarter plywood and one piece of one and a half inch hardwood exactly to the desired shape and size for the sandal.

They drilled a hole in each end of each piece so that a nail could be placed in the holes and the two parts of the jig would be lined up. A piece of rubber could be placed between them and the nail driven through to hold them in place while the cut was being made for shaping the sandal.

The engineering committee also made templates to use in cutting the pieces of rubber into proper sizes of rectangles before being placed in the jigs. They also had to work out ways of cutting the holes for placing and straps.

The production committee had the job of dividing the work into equal parts so that a group of boys could work on a line-production basis. The committee made an instruction sheet for each process. They set up a "Y" shaped production line with one branch cutting out the sandals and the other branch cutting the strips. The two branches came together at the base of the "Y" where the sandals were inspected.

The inspection committee had two jobs. First, it checked each step made by the other committees as they worked to determine when individual problems had been solved and when a process, step or method could be included in the production line. This committee was made up of members from other committees. It met periodically as a need arose to make a decision. Its other job was to inspect the finished sandals to make certain they were acceptable.

During the training period, each boy made his own pair of sandals. When production started, it was found that nearly every boy was qualified to do every job on the assembly line. They volunteered to do the jobs they liked best. There were fourteen jobs. One student never became interested in the project and so, had no part in it. In a class of fifteen boys, then, every boy had a place in the line.

The students met periodically with the president presiding to discuss problems and successes. Most discussions showed enthusiasm as boys were always eager to get on with the work. On the day preceding the final run which many outside guests would observe, students held a critique during which time they made suggestions to each other on how individual jobs could be improved.

The day after the final run was spent in discussing the values which the group had received from the project. They all agreed that they had enjoyed this more than any other work they had done. They also said they had profited greatly from their experience.

The same students that were involved in the making of the sandals designed and made the box for shipping while in their woodworking area under another instructor. The box was designed to serve as a workbench after it had served its primary purpose as a container. These boys also prepared the contents lists for the box, packed it and closed it.

Around May 15, we were surprised with the news that, through the cooperation of the Arlington County School Board, the Red Cross planned to send a teacher and a student with a team to Liberia on June 7, to spend two weeks presenting the project and teaching the production technique to the Liberian students.

I was chosen as the teacher. The student was nominated by the Industrial Arts teachers and was elected by the school administration. We chose a boy who had worked on the project in the laboratory and who, we thought, could best represent the students of Arlington County.

We chose Glenn Hall who will now tell of his experiences with the children of Liberia.

GLENN W. HALL, *Student*
in Industrial Arts
Wakefield High School
Arlington, Virginia

AN AMERICAN STUDENT IN LIBERIA

BEFORE going to Liberia, I thought I should know something about the country, its geographical location, its people, and customs. The American Red Cross provided me with pamphlets and brochures. With this literature and some research of my home library, plus visiting and talking with Mrs. Laura Tucker, cultural attaché and student advisor of the Liberian Embassy here in Washington, D.C., I felt I had learned something which would not put me at too great a disadvantage during the days to come.

However, I must say that regardless of how much a person reads and is told about a country, nothing can substitute for a visit with the people to observe them in their homes and schools.

The project was not mandatory for students in the shop of my school, Gunston Junior High, but was done on a voluntary basis.

Our team, Mr. Dyson, Mr. Flagg, Dr. Dawson, and myself, a ninth grade student, met a few times to discuss our individual roles in this undertaking.

I will start my visit in Liberia with our plane arrival at Roberts field, Liberia. We were met at the airport and motored to Monrovia, the capital city, about 50 miles away, where we checked into the Monrovia City hotel.

Next we were guests at a luncheon given by the Liberian Red Cross. When we returned to our hotel rooms, we discovered all our baggage and project tools were either in New York or on the plane.

So, for the next three days, while we were waiting for this to arrive, we got acquainted with the school administration and government officials.

Our first demonstration was held in the Monrovia National bank. There were 25 students present from several area schools. I had been asked to observe the effectiveness of the student-teacher relationship during our presentations and to assist Mr. Dyson by performing the first two steps of the project. These were "rim cutter" and "sidewall stripper." These steps were very important because it was necessary to strip correctly and get as many soles from each tire sidewall as possible.

At times I had as many as eight boys with me on these two jobs. Some of the students found I had cards with my name printed on them. Soon everyone wanted one with my address. Not only have I received many letters from these boys, but they all want to become my brother, come to America, and visit an American school. If I had been able to do this, my parents would have the largest family in Virginia!

The next week and a half was a very exciting time. We spent three days in Lamco and gave two demonstrations. Our presentations were met with the same enthusiastic response as in Monrovia.

We gave seven or eight project presentations during our two-week stay in Liberia. I found the students generally receptive to the project. The mass production techniques we employed created quite an impression.

I feel our project, "Sandals for Students" was a successful venture and would feel honored to repeat similar presentations wherever and whenever requested.

ARTHUR O. BERRY, *Associate Professor*
of Industrial Arts,
Gorham State College,
Gorham, Maine

NEW DIRECTIONS IN PUBLIC SCHOOLS

THE implementation of a program of industrial arts to reflect the technology has been a major concern to us in Maine. The revision of our state curriculum bulletin prompted a staff study at the college concerned with the need for a new departure in curriculum organization to fulfill the functions of industrial arts.

A curriculum was evolved which concerned itself with manufacturing, construction, power and transportation, electronics, and services. Research and management as an integral part of all industries were not included separately.

The introduction of such a curriculum into the schools of Maine was not a fast process. An experimental program was established at Gorham High school under the direction of William Alexander to determine the feasibility and direction that such a program can take.

Elwood Padham, newly-appointed state director of Industrial Arts, divided the state of Maine into 15 areas and the industrial arts teachers within these met and discussed the development and implementation of this new curriculum.

The unit method was found to be the most desirable means of implementing this new curriculum. It has been adapted and developed for industrial arts over the last decade under the leadership of Dr. John Mitchell and the Industrial Arts department at Gorham State Teachers College.

The source of content and experiences of these teaching units is derived from an analysis of the manufacturing construction, electronics, and power and service industries. Each unit attempts to represent a type of industry, but considers pupil interests and abilities as well.

Dean Bennett, Yarmouth Junior-Senior High School, Yarmouth, Maine, used various slides to demonstrate how he taught units on the automobile industry, the residential construction industry, basic power and transportation, and line production.

Richard Carter, Bath Junior High School, Bath, Maine, presented a talk on how he presented a unit on the toy industry, which emphasized Christmas toys.

C. Kent Clark, *Assistant State Supervisor*
Industrial Education Service
State Department of Education
Richmond, Virginia

Industrial Arts In Virginia

THE industrial arts program in Virginia has grown from three manual training courses in 1924 when students received instruction in woodworking for two periods a week, to classes in 87 school divisions in which more than 50,000 students are enrolled for a minimum of five periods of instruction per week in metal work, plastics, leather craft, ceramics, electricity, graphic arts and other subjects. Much of this instruction is given on a general shop basis covering two to four subjects.

Well-organized laboratory experiences in the 7th, 8th, 9th grades help students develop a better understanding of their interests and abilities and of industry and the free enterprise system. The program provides practical experience in the use of tools, machines, and experimental equipment and their application to modern materials and products of industry.

In the senior high school, grades 10, 11, and 12, the youth has progressed to an age where he is interested in and needs experiences considerably more extensive and complex than those provided in previous industrial arts classes. Emphasis is directed towards depth of experience and specialization in activities designed for specific curricula, namely: general, college preparatory, and prevocational or vocational.

In the general program industrial arts places emphasis upon the acquisition of knowledge pertaining to technology and industry. It stresses increased involvement in research, science, experimentation, and invention. Opportunities are offered for creative work which involves an understanding of the principles of design, and application of orderly planning, good judgement in the selection and use of materials, and skill in the use of tools and machines.

Youth at this level is already a consumer and is interested in developing ability to select and use intelligently the products of industry. The program makes for the continued discovery of youth's interests and aptitudes, as well as the strengthening of habits and attitudes of precision, orderly procedure, and safety.

Those occupational values inherent in industrial arts are further realized through understanding of the coordinate roles of the scientist, designer, engineer, technician, laborer and manager, coupled with the related phases of industry.

Finally, the general program aids the fulfillment of general education objectives by helping the student develop an understanding of the social impact of industry on modern society while he develops skills for possible avocational interests.

Industrial arts in the college preparatory program is designed for intensive experiences for the youth who is planning to attend college. The criterion for selection of activities depends on the objective of the youth. Activities typical of this program are architectural drawing, mechanical drawing, applied science, electronics, and such other experiences which will challenge his talents and give enriching related experience to his academic subjects.

Preoccupational program in the senior high makes provisions for intensive experiences for the youth who shows interest in or aptitude for specific industrial or technical fields. The quality of craftsmanship and technical "know-how" is directed toward depth of experience and a high degree of accuracy and competency in a specific area of industry.

Youth has an opportunity to receive this specialized training in the 11th and 12th grades in either the industrial arts laboratory or in Industrial Cooperative Training programs. Youth completing this program may continue on at an area vocational-technical school or enter an apprenticeship in the field of his specialty.

Virginia does not have a standard program of industrial arts for all schools. Were you to travel the state and visit various sections you would find different philosophies and different types of programs. We have some unit shops in which a student may take four years in a given area and this may be the only offering in industrial arts in these schools.

Even though Virginia does not have a standard program for all schools, we do recommend that three catagories be offered: (1) communications, which includes the areas of drawing and design, graphic arts, electricity, and electronics; (2) manufacturing and construction, which includes woodworking, metalworking, leather, textiles, and ceramics; and (3) power and transportation, which includes automotive, marine, and mechanics. A few schools are considering hydraulics and chemicals but little is being done in these areas.

In the 7th, 8th, and 9th grades we recommend a minimum of nine weeks in any one area. For example, if a student takes industrial arts for one semester he should cover two areas. If for a full year he should have experiences in four different areas.

The length of time an area is offered in the senior high school should be a minimum of 18 weeks and may be a full year in length. This is especially true if there is not a vocational program in the school.

In Virginia, industrial arts is under the supervision of the Industrial Education Service which is a part of the vocational department. However, industrial arts, although administered through Vocational Education is not considered as vocational. This means that there are no funds appropriated for industrial arts in the state budget. An assistant supervisor of Industrial Education attempts to supervise the state program along with other duties. We have requested a full-time supervisor but this has not materialized.

Even though statistics show that our enrollment has been increasing since 1957, we may need to analyze these figures a little more closely. Several new programs have been added. In many localities industrial arts is a required subject for at least one semester on the junior high school level. Because of this we have our largest enrollment in the eighth grade. In the senior high school, since the emphasis on foreign language and science, our enrollment has dropped.

We are having some difficulty with the agriculture department starting a so-called general mechanics class in both the junior high and senior high schools. The class is open to all students and the offerings are in the areas of wood, metal, drawing and power mechanics. This is a one-period-per-day class and is reimbursible under the vocational agriculture program.

Recently Virginia had a study commission which recommended, and the General Assembly approved, appropriations for increased programs in Vocational Education. How this along with federal legislation and the general mechanics course will affect industrial arts remains to be seen.

In 1955, we had similar state legislation and our enrollment dropped approximately 5,000 students. It is hoped that if we can continue to update our industrial arts classes and show that they are beneficial to all students, our program will continue to grow.

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INDUSTRIAL ARTS EDUCATION IN WISCONSIN

WISCONSIN, America's Dairyland, has an area of 56,154 square miles and a population of 3,952,000. There are 16 cities of over 30,000 population of which Milwaukee (741,000), Madison (126,000), Racine (90,000), West Allis, Kenosha, Wauwatosa, Janesville, Beloit, and Waukesha are located in the south half. It the present growth development continues it is quite likely a "Megopolis" will extend along the shore of Lake Michigan from Green Bay south to Gary and Hammond, Indiana.

Wisconsin was considered a frontier area in the 1830's, but grew to an important industrial state because of the Great Lakes shipping facilities. It is best known for the dairy industry, major metal products such as farm machinery, earth-moving equipment, machine tools, and the diversified products of electrical goods, paper, plumbing ware, graphic arts, wood and wax products.

In the school year 1960-61, 497 public secondary schools were in operation in Wisconsin of which 69 were junior high schools, grades 7-8-9 and the remaining 428 were either 1-12, 9-12, or 10-12 combinations. Of the 69 junior high schools 56 had full-time Industrial Arts instructors, seven had combinations, and six had no Industrial Arts. The remaining 428 schools had 172 full-time Industrial Arts, 153 were combinations and 103 offered no Industrial Arts.

There are 114 schools with less than 300 pupil enrolled and only 9 with a student population of over 2,000. Thirty-two secondary schools do not offer Industrial Arts or plan to because of enrollment and space limitations.

Industrial Arts is most frequently required at grades 7 and 8, and some schools require it at ninth grade. There are 19 schools requiring Industrial Arts for girls at 7th grade and 16 schools for 8th grade.

The one teacher shop is most common with 33 per cent of the Industrial Arts teachers in this category. The four or more man department is next most common claiming about 30 per cent. The two-man department constitutes 16 per cent and the 3-man 21 per cent.

Approximately 51 per cent of the teachers are in the 25-39-year-old age bracket and two-thirds of the total have 15 or less years of teaching experience of the 727 persons who were listed in the state report as Industrial Arts teachers.

We have had some set-backs in Wisconsin in the post "sputnik" panic but on the whole, Industrial Arts is gaining in status, with most programs growing. The past six years in Racine have been rapid growth years with over a 100 per cent growth in staff from 18 to 37 Industrial Arts teachers.

As we plan a new high school presently, we are thinking of seven shops and an additional 10 men, with offerings in drawing, wood, metals, electricity-electronics, graphic arts, and power technology as our latest offering. Other cities have been offering auto mechanics but we intend to make our offering broader to include the newer concepts of power creation and transmission.

The future is bright and I am optimistic that Industrial Arts in Wisconsin will grow if we are prepared and willing to show the necessary leadership. I think we will continue to grow to meet the needs of Wisconsin youth.

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INDUSTRIAL ARTS EDUCATION IN THE STATE OF MISSOURI

INDUSTRIAL education came to Missouri in the latter years of the 19th century, with the beginning of the Manual Training Movement. In 1880, Calvin Milton Woodward established, in St. Louis, the first manual training school in the world.

This type of education has undergone much change and is now more appropriately known as Industrial Arts. All triple A schools in Missouri are required to offer one year of Industrial Arts in the 7th- and 8th-grade program and most public schools do offer some form of Industrial Arts. At the Senior High level, through grades 9-12, Industrial Arts courses are offered as elective subjects.

The programs offered in the schools vary considerably, depending largely on the size of the school. Here we see the effect of population on our Industrial Arts programs. Probably 75 per cent or more of the secondary schools in Missouri would be called small schools, where the Industrial Arts teacher is required to teach in several areas, and classes are small.

In the large, heavily populated areas, classes are large, and more specialization is possible. This also presents problems for our teacher training agencies. In Missouri most Industrial Arts teachers are trained in the five state colleges and the state university. In recent years demand for teachers has exceeded the supply, despite the fact that the Missouri university graduate program is regarded as one of the largest and best in the nation.

It is "too true" that men who are trained to teach Industrial Arts can find more remunerative jobs in Industry and we *do* lose valuable man power yearly to other professions. That is *one* of our big problems.

Physical factors affect to a great degree the offering of our Missouri schools in the Industrial Arts field. The small school, with small classes, finds it feasible to have the general shop where all areas of Industrial Arts must be taught.

Area offerings in such schools in Missouri are blue print reading, drawing, woodwork, metalwork, electricity, graphic arts, etc. No real depth of training is attempted in these areas. The experiences are intended to be exploratory.

In the large schools of the state the general shop is not popular because of the difficulty of handling the large number of students in such a plan. Better results are achieved in these schools when single areas are taught to an entire class.

Thus, the trend in these large schools is for the Unit shop to replace the General shop. The large schools offer many areas of work, too, and in some instances the student may even specialize in his training. For instance, in St. Louis it is possible for a student to take two semesters of mechanical drawing, followed by 4 semesters of machine drawing or 4 semesters of architectural drawing. In Kansas City and St. Louis, more than 30 semesters of industrial arts courses are offered in the Senior High Schools. Teacher supply is particularly inadequate for these advanced courses!

We who are directing Industrial Arts in St. Louis feel that in a large city such as ours we have need for the Industrial Arts program in every high school *and* a vocational high school. In fact, our new 11-million-dollar Trade School is not adequate and we feel that we need further vocational facilities. This does not replace our programs in our general high schools nor do we expect it to. In some school districts, however, availability of money to support the program seems to be the determining factor of whether a program is vocational or local. This is of concern to Industrial Arts people, as the needs of the community and the youth should be the factor to consider.

The problems we are experiencing in Missouri are no doubt the same as other states are having; the one already mentioned is that of securing and holding quality teachers. Professionally, we have found it a bit hard to unite our groups into any strong organization.

We have one state organization for Industrial Education Teachers known as M.I.E.A. (Missouri Industrial Education Association). This group has a potential membership of 1,100 but an active membership of 700, of whom about half are Industrial Arts teachers. Last year, Missouri ranked 16th in A.I.A.A. membership with about 200 members.

Being a large state, it is impossible to expect our men to travel the distance that even infrequent meetings would necessitate to attend state meetings of an organized group. There is need of a plan whereby travel expenses for Industrial Arts professional meetings would be reimbursable, as is now done for the vocational educators.

We hold an annual state association meeting of all teachers in either Kansas City or St. Louis for those who desire to go to a state teachers association. However, teachers may elect to attend their district association meeting instead, so there is really no time when *all* of our Industrial Arts teachers could get to a meeting, as the situation now exists.

We have no supervisor in our State Department of Education to give full time to the Industrial Arts area. The large school systems provide their own local supervisors.

The A.I.A.A. has gone on record as recommending the establishment of a consultant or supervisor of Industrial Arts within the Department of Education which would promote and coordinate the program in the state. Missouri Industrial Arts teachers feel that there is the *need* for full-time leadership in their state.

We are encouraged that progress is being made through the leadership of Dr. Roland Nagel, professor of Industrial Education at Northeast State college, Kirksville, Missouri, who is presently serving as president of the Missouri Industrial Education association. He has organized an Industrial Arts Advisory Council within the M.I.E.A., whose function is to promote and coordinate Industrial Arts activities. In this plan, teachers are encouraged to contact the Council member who represents their district for any suggestions or comments concerning desirable state activities. The state has been organized into 7 districts under the leadership of a council member.

Each district is busily engaged in planning for Industrial Arts fairs. The winners at the district fairs will be eligible to compete at the first state awards program to be held in May at the State university.

Several scholarships are available to senior winners who have intentions of teaching in the field of Industrial Education. In this way we are doing a little to help meet one of our problems, which is quality teachers. I understand that our M.I.E.A. has made application for affiliation with the A.I.A.A., and we will probably hear soon of action relative to this.

We regret that it was impossible to select our outstanding Industrial Arts teacher as home states do under the plan sponsored by the A.I.A.A. But since we have no *one* person who has traveled over the state in an advisory or consultant capacity, a fair choice could not be made.

Many Industrial Arts teachers have been assisting as staff members in the administration of the project known as Youth Manpower project, which has been carried on in Kansas City, Joplin, and St. Louis. The majority of the participating trainees are school drop-outs, 19-21 years of age, who have been unable to get jobs.

Groups of 80-100 boys begin their training at one time. During the first 12 weeks of training, the trainees spend their time in exploratory shops. Then after thorough counseling and testing services, they receive up to 40 weeks of vocational training in the field selected as most desirable. There is opportunity for additional training, if needed, in reading and mathematics. Under this plan, a new group is started every 12 weeks, thus four groups a year are trained. No doubt many of you have assisted in such programs. Such programs are also valuable for the persons who have lost jobs through automation, allowing them to retrain themselves for more saleable skills.

Those programs are good and do serve a need, but wouldn't it be less costly to make our high school programs so vital and attractive that we would not have the great problem of the drop-outs? Can it be done? Only through *quality teaching*.

The school district of Kansas City, Missouri, in cooperation with the Ford Foundation and the Kansas City Association of Trusts and Foundations, is conducting a research project with boys attending academic classes for half-day sessions and working for half of the day outside the classroom.

This work-study program is designed especially for boys (13-14 years old) having difficulty in school and who are likely to drop out upon reaching age 16. Missouri has a compulsory attendance law which stipulates that students must attend school until they are 16.

Approximately four hundred boys were elected and divided into control and experimental groups. Boys in the experimental group are given a modified curriculum for the academic portion of the school day and participate in these stages of work as they advance through the program. The control group continues in the regular program offered by the school.

The boys were 13 and 14 years of age when they entered the project. The program is presently in stage two of the work portion.

On the first level of school work experience, the boys spent half of the school day on basic subjects of reading, arithmetic, writing, English, spelling and citizenship. The half-day work portion involved training in using simple tools and doing socially useful work. It was a time for the boys to learn about themselves, more about working together, and a time to develop and improve work habits and an awareness of employer expectations.

Results thus far indicate the plan has merit. There appears to be fewer drop-outs among the work-study group than in the group not participating.

Industrial Arts is advancing in our state despite the excitement about the space-age need for greater emphasis on science and math. We now see that relatively few will be closely involved in the space race and there remains (1) the greater masses of young people to be prepared for living in this age of technical advance; (2) groups to be relearning and learning for new jobs; (3) problems brought on by automation and more leisure time to cope with.

This sounds like a big task but it can be done. If we will strengthen our teacher preparation and do it without delay, if we can provide the needed in-service training for teachers now on the job and make our salaries competitive or better than industry, then continued success in our field will be assured.

It would be very helpful if some of the funds provided in the new Vocational Act passed in December could be channeled into use for the purpose of teachers improvement for I come back again to the same point—we must have *quality teaching!*